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Activity in New England. OUR pages are largely taken up this week with New England matter, and it will be seen from the reports of our New England representative that the section of the country thus receiving special attention is very actively engaged with electrical enterprises, improvements and questions, the outlook being cheerful and encouraging.

Prohibition of Mail Trains. THERE is a very strong feeling in Pennsylvania against mail trains. How it arose is explained by the following special dispatch from Johnstown of Jan. 6: "The mail train west-bound on the Pennsylvania railroad to-night killed two men at Tyrone, one of them being the train dispatcher; the other has not been identified. They were walking on the track when struck. At Ben's Creek, about 12 miles east of here, the train also struck and killed two men, supposed to be Hungarians in the employ of the railroad. They stepped in front of the engine and were terribly mangled. The train was stopped, the bodies taken aboard and brought to this place, where they now lie awaiting identification. Two miles further down the road from here the train struck an omnibus which runs between Johnstown and Morrellville, and almost killed a woman." Evidently mail trains of the high tension kind must stop.

A Giant at Play. AN article which we print in this issue presents Mr. Edison in a most charming and amiable light, that of advising two bright young New Yorkers who had sought his kindly assistance, as to the best means of operating their electric launch. We ought, perhaps, to say that we publish Mr. Edison's letter without permission, as mere accident threw it in our way; but we feel that no harm will be done in thus showing how ready one of the busiest men of his time has been to help along those who, no doubt, were stimulated by his own great fame and example.

Control of New York Subways. WE understand that steps are being taken by which a new subway construction company will attend to the underground electric lighting work in this city. It will be composed chiefly of the officials of the local lighting companies, who will build and control their own subways. The old subway company now holding a contract with the Board of Electrical Control will devote its energies to subways for telephony, telegraphy and other work of that class. It is hoped and believed that by this means some way of dealing with the situation more effectively will be reached.

Guarding Against Broken Lines. IN the operation of electric light lines it sometimes happens that by the parting of the wires the ends fall on neighboring wires or metallic roofs, which serve as a conductor for the electric light current, and hence may lead to untoward consequences. To avoid this difficulty, therefore, Mr. E. P. Clark, of the Clark Electric Company, of this city, has recently designed a simple apparatus by which, on the instant of a break occurring in the circuit, the dynamo ceases to generate current. The dynamo then remains inoperative until the break is repaired. We have recently seen the apparatus in actual operation, and it performed the functions above described with certainty during the tests which we witnessed. The apparatus seems well calculated to afford an additional safeguard for overhead wires.

Low Tension Walls. BROOKLYN saw two serious accidents last week from the blowing down of high walls. In each case life was lost, and several persons were injured. Owing to the panic worked up on the subject by the local papers, an ordinance has been adopted in the city council forbidding the erection of any wall over one story high. In other words, only low tension walls will be allowed. It is also said that a board will be formed to regulate this matter, and to pull down any wall above one story in height which might possibly fall down and kill somebody. The advocates and supporters of these measures, in replying to the argument that the effect will be to spread Brooklyn out over a tremendously large and unwieldy area, say that the city has horse cars, and can fill up all Long Island. The farmers in the rural districts are enthusiastic supporters of the scheme, seeing in it an opportunity to do well with their real estate.

Improvements in the Quadruplex. THE difficulty in quadruplex working introduced by the employment of high resistance cells, has been a source of much trouble in the operation of this apparatus, and it is, therefore, of interest to know that an improvement in this direction has been made which has resulted in a marked increase in the efficiency of the quadruplex. The description which Mr. Healy gives of his recent improvements shows that, by diminishing the resistance of the battery, the E. M. F. can be considerably reduced, while at the same time the current available for the line is largely increased. Again, the adoption of safety fuses as safeguards against fire and burning of the points as against the usual resistance of two ohms to the volt is a distinct gain, and, in fact, an advance in this department, in which safety resistances have been almost exclusively employed from the beginning. The removal of much of the auxiliary apparatus heretofore employed to effect the transmission and reception of clear signals must be looked upon as a distinct improvement in quadruplex telegraphy, as, by the removal of the cause, the preventives become unnecessary.

Compass Records. IT has long been recognized that if a permanent record could be kept, automatically and continuously of the course traveled by a ship, much information could be gained, and, indeed, considerable economy effected in the time of the ship's passage and also in the fuel consumed. The recording of the position of the needle at any given time may, of course, be very easily accomplished by means of electrical devices, but the one great difficulty which has always presented itself in this connection has been, that the introduction of electric circuits in proximity to the compass was likely to have a disturbing influence on the needle, and this, of course, was not permissible. Without deeming it necessary to trace the history of these many attempts, we would only call the attention of our readers to the latest method proposed to overcome the defect just noted. The device of Mr. Chase, described elsewhere, is so designed that the compass is under the influence of the current for but the fraction of a second each minute, and at that time is fixed in its position. The records obtained in this way should afford ample means of checking the vigilance of the wheelsman, and, if generally adopted, might go far toward avoiding accidents due to carelessness, and which are at present beyond the control of the commanders of vessels.

A Constant Current Alternator. THE alternating current, which, in the early days, lay under the ban of disability to perform several functions which the continuous current was capable of, is gradually increasing its range of application, so that to-day it is able probably to perform every function which may be demanded of an electric source, including even, it may be said, with proper restriction, the charging of storage batteries. One of the latest additions to alternating current apparatus is an automatic continuous current machine, designed to operate without the intervention of external regulating apparatus. Mr. William Stanley, Jr., whose machine is described elsewhere, has, by making the armature winding of high resistance, succeeded in maintaining a practically constant current under wide limits of load. The principles involved in the machine are very interesting and include the action of the relative resistances of the magnetic circuits. Our readers will, in this connection, remember the constant current transformer designed by Prof. Elihu Thomson and described by us some time ago, in which an air space afforded a bridge for the lines of force, by which arrangement the current was maintained constant in the secondary of the transformer notwithstanding the varying resistance in the external circuit.

Insulation Materials. IN an able editorial review of the art of insulation, the London *Electrician*, in a recent issue, points out the salient features of what constitute the necessary qualifications of the insulator to confine the electric current within its proper path under the varying conditions in which it is used. It is evident that next to the knowledge of the laws and properties of electricity comes the teaching of experience in its application to the various circumstances of the case, and then sound, conscientious workmanship in execution. The rules thus derived and rigidly applied will not fail to fulfill the demands, and the number of insulators, both natural and artificial, is so extended, and their character is so varied, that a good choice can be made in probably every case met with in practice. As our contemporary points out, the laboratory test of insulation resistance should not be implicitly relied on in such instances, but should be supplemented by a test approximating to the conditions of actual practice. That the latter excellent point is being recognized is evidenced by the fact that in the equipment of the new factory of one of our largest insulated wire and cable manufacturers, a special arc-light testing dynamo has been installed which will be employed in the testing of the company's arc wires and cables. The practice is one which will bear imitation.

Duplex Telephony. THE recent description which we gave of a duplex telephone system lately patented by Dr. Rosebrugh, of Toronto, has afforded a very good text for a discussion of the problem involved in duplex telephony, by Mr. John A. Barrett. The large amount of work which this gentleman has accomplished in the field of telephony, together with its acknowledged value, entitles the article to more than passing consideration, and the more so since he himself is also the inventor of a duplex telephone system. After thoroughly analyzing the theory which is involved in the operation of duplex telephony, Mr. Barrett is of the opinion that duplex telephony, in the true sense of the word, is not yet an accomplished fact; that is to say, when looked at in the same light as duplex telegraphy. In other words, there had not yet been devised a system which is able to analyze between two telephonic sounds at one end of a line and to differentiate between them at the other end. According to Mr. Barrett, the most that has been done in this direction so far has been the reduction of the number of lines such that there is only one circuit less than the number of wires which would be ordinarily used for single transmission, the rest all being metallic circuits. Mr. Barrett lays great stress upon the important advance made by the adoption of the metallic circuit in place of the earth return, and without which multiple telephony could not be accomplished. But, as pointed out, although duplex telephony seems still in a tentative state, the use of the line for the ordinary telephone purposes can be very well combined with the telegraph use; and actual experience has shown that such systems based on the duplex telephone arrangement can be carried out without the slightest interference. The question might be asked why this is not done in this country on the large and growing number of long distance telephone lines; but the answer may be looked for in the fact that the patent covering this system, and issued to Mr. F. Jacob, is owned abroad. Mr. Barrett's article is well worthy of perusal by all interested in this subject.

NEW BOOKS.

Absolute Measurements in Electricity and Magnetism. By Andrew Gray, M. A., F. R. S. E. Second edition, revised and enlarged. Macmillan & Co., New York, 1889. 384 pages. 4 × 6½ in. Price $1.25.

In 1883 the author published in a small volume a valuable compendium of the latest and most approved theory and practice of absolute measurements, which deservedly met with the approval of a large number of students. Encouraged by the success of this work, he has more recently undertaken the elaboration of many of the subjects barely hinted at in his original attempt, and the first volume of this new work appeared during the last year. That book, which we reviewed at the time, seems to have carried the author to the other extreme, and he has been prevailed upon to condense much of the matter contained in his larger, more complete work, and to bring out a volume which shall place in the hands of the student the salient features of that work without occupying too large space. We must say that in this third attempt the author has succeeded admirably. In view of the past notices on the work in question, it will be unnecessary for us to enter into a detailed discussion of it, but we may add that even in this condensed work matter has been added which is not contained in the larger, including a fuller determination of *H*, a description of Sir Wm. Thomson's standard electrical instruments, a more complete treatment of the graduation of instruments, especially by electrolysis, and the theory of alternating machines extended so as to include Dr. Hopkinson's theory of the working of alternators in series and in parallel. We can heartily recommend this volume to all interested in this most important and fundamental subject.

Practical Notes and Definitions. By W. Perrin Maycock. E. & F. N. Spon, New York, 1889. 3 × 5 in., 130 pages. Price, 60 cents.

This very convenient little pocketbook contains many useful facts and hints which enter into the everyday practice of the electrical engineer, and in addition is calculated to be of use to others besides those engaged in electrical pursuits, persons whose work frequently brings up electrical questions, such as architects and civil engineers generally. The author has reduced into a very condensed form many practical rules and explanations of wiring, lightning conductors, circuits, batteries, bells, etc. The electric light, transmission of power and telegraphs and telephones are also treated of; and among the rules and regulations for fitting up electrical installations are those of the London Institution of Electrical Engineers and the Phœnix Fire Office. The little book, though not likely to take the place of other more complete pocketbooks, will nevertheless be found of value to those who are about to start out in electrical work.

Practical Electrics. E. &. F. N. Spon, New York, 1889. 135 pp., 5¼ × 8 in. Price, 75 cents.

This is a reproduction of the chapter on "Electrics" in the third series of "Workshop Receipts" by the same publishers, but it may be said to be something more than a mere tabulation of well-known rules of practice, such as is usually found in workshop receipts. Although the aim has been to give the amateur and others interested in electricity practical information regarding the various apparatus described, the principles of operation have by no means been neglected, and, as a result, the book is well designed to aid those who wish to take up electricity as a pastime in their idle moments. The volume contains complete descriptions and information regarding all kinds of alarms, batteries, bells, dynamos, measuring instruments, motors, telephones, etc., and in addition contains much information concerning the accessory apparatus which is employed in nearly every electrical installation, no matter of what description. Wherever possible, the work has been illustrated with clear engravings, so that the reader is guided to a very considerable extent as to the actual construction of such apparatus. For those who have electric bells, telephones or electric lights in their houses, the book will be a very convenient and accessible source of reference, enabling them to utilize to the full the many opportunities which the presence of a source of electricity affords in the household.

A New Quadruplex Telegraph System.

BY CLARENCE L. HEALY.

When the modern quadruplex was first introduced we had nothing but battery current working our lines, and the gravity battery with its high internal resistance had taken the place of the older Grove and carbon batteries of low resistance.

The principle of the quadruplex consists in operating a telegraph line by sending two distinct messages over it from each end, and the electrical conditions to obtain this are, first, a small reversed current for one transmission, and, second, a greatly increased current, without reference to its polarity, for the second side. The failure of the modern quadruplex in a great measure has been due to the inability to maintain a sufficient difference of potential and corresponding strength of current at the distant station from the home battery.

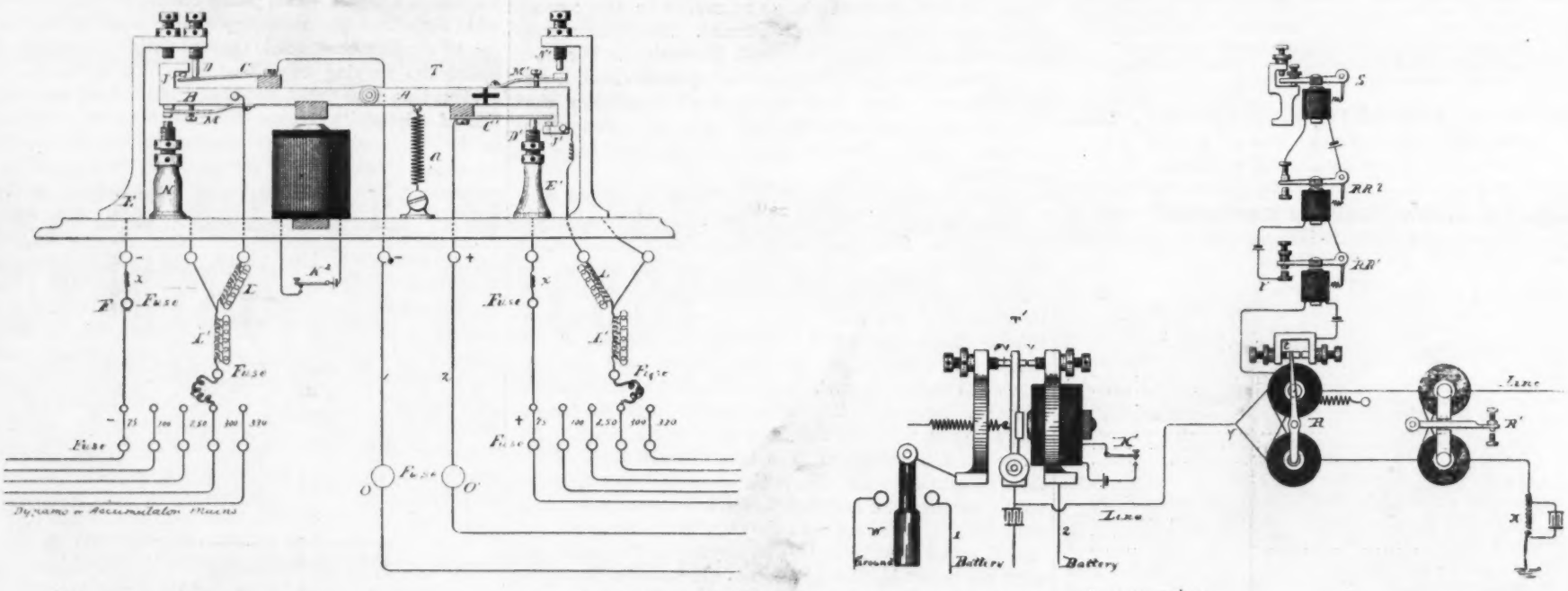
An ordinary line between our principal cities measures about 3,000 ohms. Early in the practice of quadruplexing wires a large low resistance conductor was found necessary to operate this system at all, and at the present day anything less than a No. 6 wire is not thought practicable to work a "quad." This is due to the inability to maintain a proper potential to the line, and with a high resistance conductor the arriving current for the second side was too small to operate, except under the most favorable conditions. This line of 3,000 ohms, when it has an artificial line attached to it through the differential relays to balance it, has now a joint resistance offered to the battery current of but 1,500 ohms; and when 300 cells of gravity battery are connected, as they are by the second side transmitter, the actual potential going over the line is the potential arriving at the joint lines, due to the fall of potential in the battery itself. Three hundred cells will measure 900 ohms or more, and the loss in the battery will be the percentage this battery resistance bears to the joint resistance of the line, and artificial, which usually brings it down to over one-third in clear weather. and in heavy leakage this loss greatly increases, due to the lowering of the joint resistance, and then follows the failure to deliver at the distant end sufficient current to operate the second side.

Upon the introduction of the dynamo quad, this objection was slightly overcome by the lower artificial battery resistance used between the dynamo and pole-changer, being usually two ohms to the volt; but this still caused a large percentage of loss. This resistance, as used, is a necessity in order to prevent the burning of the contact points of the increasing transmitter, at the time of passing from the lower to the higher potential dynamo, as there is a short interval of short circuit; and unless this current is kept at a low quantity, it would burn the points and prevent the proper operation of the system.

We have seen that in order to successfully operate a line quadruplex, our battery resistance must be low, and that it must bear but a small percentage to the resistance of the joint lines, the same as is necessary in operating a number of incandescent lamps from one source of current. In order to accomplish this, I have devised a complete key system, the transmitter *T* being shown in Fig. 1. On each side are shown the leads to the different potential dynamos, with — and + poles. These are conveniently arranged on a separate switchboard, where the chief operator can make any change in potential and resistance to meet the requirements of the line and weather. The low — potential of 75 volts is shown connected to standard *E*, point *D* and spring *C*, wire 1, to the pole-changer, Fig. 2.

The arrangement at the + end of the transmitter being the same, connected to standard *E′*, spring *C′* and wire 2, allows the pole-changer to send reversed currents of 75 volts to the line. Now, if key K^2, Fig. 1, be closed the spring *C* moves down, and contact is made with point *J*, through resistance *L L′*, to, say, the 300-volt high potential. The resistance *L* is adjustable, and is always made so that the current, momentarily short circuited at the points *D* and *J*, is greatly reduced, so that not a trace of a spark is seen. The further downward movement of spring *C* causes it to leave point *D* and the contact spring *M*, which forms part of the circuit, then touches a point on *N*, which shunts the resistance *L*. This puts the high potential through a small safety resistance L^1, which is adjustable, and the percentage of loss in the safety resistance can be maintained at 5 per cent. of the joint lines. The upward movement reverses this operation. By this arrangement there is never any sparking at the contacts, no matter how much we increase the potential and current on the line. The use of the resistance *L* puts the current gradually to the line in the shape of a wave, instead of a sudden rise, which in a great measure prevents induction on neighboring wires.

The positive potential is transmitted in the same way, the pole-changer determining which pole the current flows from. The pole-changer points are set close, so that the break shall be as short as possible. The possibility of putting to the line nearly the initial potential allows of a much lower potential being used, and the tendency of arcing and short circuiting at those points is greatly reduced. This is evident when it is seen that with a potential of only 200 volts more current is sent to the line than with 300 volts, where the great loss occurs in the artificial and battery resistance. This shows what a great gain can be made in current to operate in wet weather.



FIGS. 1 AND 2.—HEALY'S NEW LINE QUADRUPLEX.

The pole changer points are protected by safety fuses *OO′*, of tinfoil, which melt on a slight increase of current. It has been proved by experience that a low melting fuse is a greater safeguard against fire and burning of points than a resistance of two ohms to the volt, that will upon short circuit, heat up and gradually burn the points, if not discovered. In regular operation the use of this fuse is seldom brought into play, as the chances of arcing at the polechanger points are very small.

The neutral relay and its local connections to the repeating sounders are shown in Fig. 2. This neutral relay was described in this paper in the issue of Aug. 3, 1889. To still further prevent the tendency on long lines to mutilate the signals on this relay during the period of no current, a repeating sounder $R\ R^1$ is connected to the armature points of relay *R*; the repeating sounder $R\ R^1$ closes the circuit of the ordinary up-contact repeating sounder RR^2. The use of this repeater $R\ R^1$ is to lengthen the time movement of *R* at reversals. In this way, during the time of no current, with the tendency of the armature to fall back on the contact point, the contact must be long enough to bring RR^1 to its down contact before RR^2 and sounder *S* are affected. By this arrangement the slight fluttering contact of relay *R* is not felt on *S*.

With this relay and local arrangement all condensers and induction coils and extra magnets, to "kick" a current through either windings on the relay, or extra magnets to hold the armature steady at reversals to prevent the mutilation of the signals, are done away with. And the removal of all extra resistance and choking effect of induction coils greatly benefits the practical operation of a telegraph line quadruplex.

The Chase Recording and Alarm Compass.

One of the notable exhibits at the late Maritime Exhibition in Boston was a recording and alarm compass, and, besides being a decided novelty in its way, promises to be of great value as a means of safety and economy for all seagoing vessels. The machine, which is illustrated in the accompanying engravings, is the invention of Mr. Henry A. Chase, electrician of the Boston Police Signal Service, and was constructed at the factory of Messrs. J. P. Cushin & Co., of Boston, and designed specially for Mr. Cushin's steam yacht "Gleam," a fine boat, about 100 feet in length.

FIG. 2.—THE CHASE ELECTRIC RECORDING AND ALARM COMPASS.

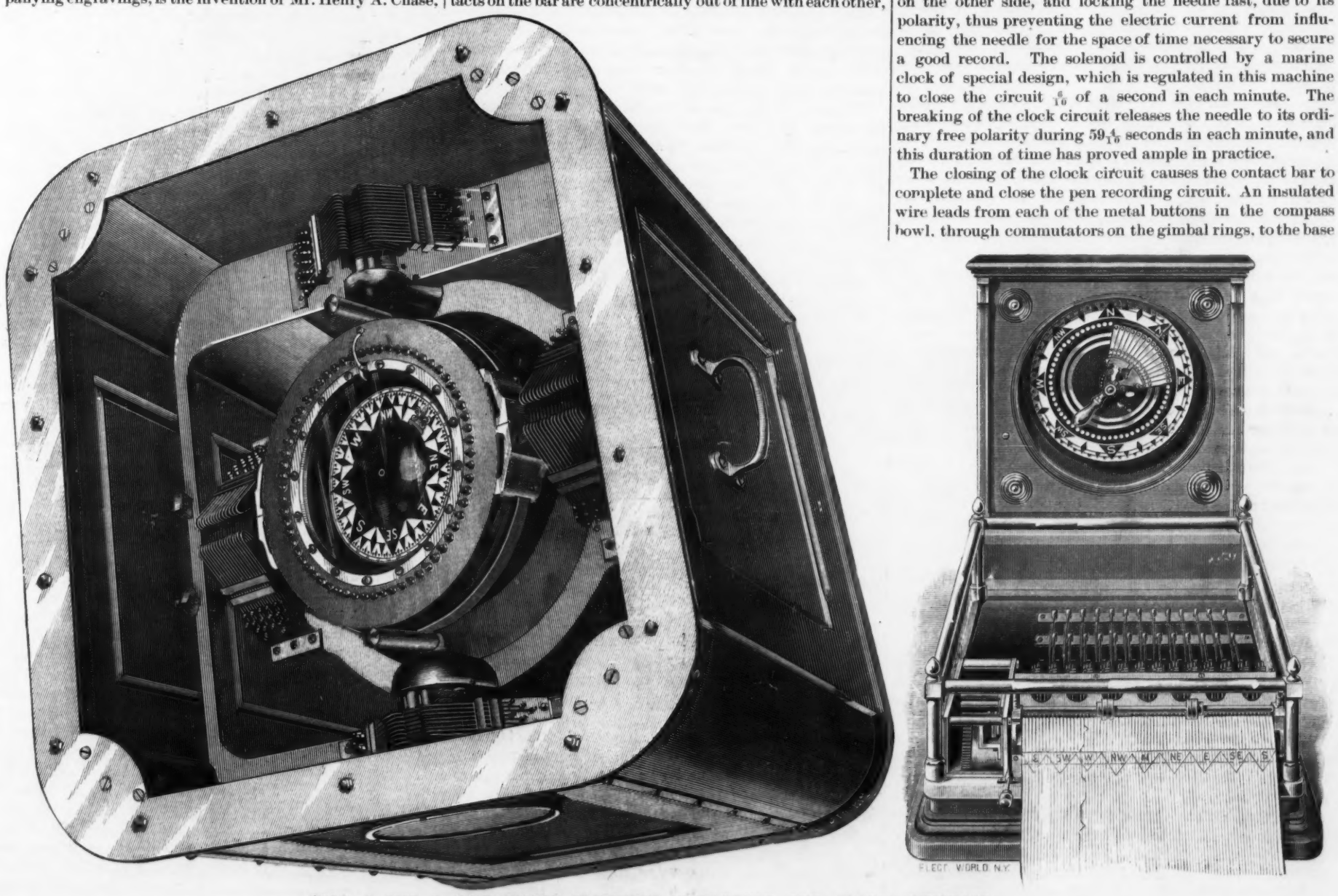
The loss of the "City of Columbus" some few years ago, on a clear winter's night, involving the loss of 101 lives, simply by reason of being allowed to run a few points out of her course, with no means whereby the sleeping captain could detect the wheelman's dereliction of duty, led Mr. Chase to devise this machine. The apparatus is composed of a binnacle, shown in Fig. 1, located in any part of the ship, and the recording and alarm instruments, Fig. 3, which are preferably located in the captain's cabin, the two machines being connected by a cable of insulated wires.

The binnacle contains a Ritchie liquid compass of the standard pattern. Attached to the compass needle, and swinging freely with it, is a light frame, provided at its ends with contacts and having a vertical motion independent of the needle and called a contact bar. The contacts on the bar are concentrically out of line with each other, the outer contact registering with a series of metal buttons, which represent the points and half points of the compass, and the inner contact registering with a continuous metal ring, the button series being a part of compass bowl. The centre of this contact bar terminates in a flat ring, through which passes the point that supports the needle and contact bar.

Half an inch below this flat ring is a similar ring, which forms the upper head of a piston armature, the lower end of which has a vertical motion within the coil of a solenoid. This solenoid is of peculiar construction, and is in the axial line of the needle and bar, being thus located to preserve a magnetic equilibrium with the needle above at all points of the compass; it is attached to the compass bowl, so that whatever position the vessel assumes, it is vertical to that plane.

The energizing of the solenoid causes the piston armature, with its flat ring head, to engage the ring of the contact bar, driving it to a contact with the metal ring on one side, and some one of the metal buttons selected by the needle on the other side, and locking the needle fast, due to its polarity, thus preventing the electric current from influencing the needle for the space of time necessary to secure a good record. The solenoid is controlled by a marine clock of special design, which is regulated in this machine to close the circuit $\frac{6}{10}$ of a second in each minute. The breaking of the clock circuit releases the needle to its ordinary free polarity during $59\frac{4}{10}$ seconds in each minute, and this duration of time has proved ample in practice.

The closing of the clock circuit causes the contact bar to complete and close the pen recording circuit. An insulated wire leads from each of the metal buttons in the compass bowl, through commutators on the gimbal rings, to the base of the binnacle, and thence through a cable to the registering and alarm instrument, Fig. 3, connecting with as many electro-magnets as there are points and half points of the compass. The armature of each magnet is provided with



FIGS. 1 AND 3.—THE CHASE ELECTRIC RECORDING AND ALARM COMPASS.

pricking point to perforate a slow-moving band of paper unrolled by clock work, and ruled longitudinally to correspond to the half points of the compass, and transversely corresponding to the time. The return wire of these magnets connects with a battery and thence back through the cable and gimbal to the metal ring of the compass bowl, the circuit being completed through the contact bar, when it is driven up by the solenoid.

The operation of the machine consists simply in the clock closing a solenoid circuit $\frac{6}{10}$ of a second; this, in turn, through the contact bar, closes some one of the recording magnet circuits selected by the needle, thus locking the needle from electric disturbance and polarity for an equal length of time. The breaking of the clock circuit removes all current from the compass and restores the needle to its normal polarity for $59\frac{4}{10}$ seconds.

The port or starboard alarm is obtained by a specially designed rotating switch provided with two sub-switches, which register and make contact with a circular row of metal buttons in branch connections, with wires leading from buttons in the compass bowl. This switch is surrounded by an index, on which is marked all points and half points of the compass.

The practical operation of the apparatus is as follows: The course being given, say, N. W., the switch is rotated until the pointer rests on N.W. As long as the vessel holds a N. W. course the bells would remain silent. A deviation of half a point in either direction, however, would cause the starboard or port bell, as the case might be, to sound an alarm every minute until the course was held again. By the use of the sub-switches a range of silence can be obtained of three points to the starboard or port. The course set by the captain on this machine in his cabin must be held by the man at the wheel, for the record and bell will both show the error every minute until rectified.

On Nov. 4 last the apparatus was placed aboard the steam yacht "Gleam," Capt. Thompson commanding. The binnacle was placed on deck and the recording and alarm instruments in the saloon below deck, and the two machines connected by a cable 25 feet in length. Runs were made every day for a week, and set courses to nearly all points of the compass were tried; running around in a long circle, followed by short turns; steaming around sailing vessels, buoys, etc., but the machine in the cabin never failed to record every variation.

On Nov. 10 a test was made of the apparatus in a heavy seaway during a northeast blow, when, at times, the yacht was almost scuppers under. During this test of its capacity the instrument kept steadily at its work, whether the yacht was keeled over and nearly on its beam ends, or running smoothly on an even keel, ticking off its contacts every minute with unfailing regularity, and stamping indelible every minute variation of the course. The week's trial showed conclusively that it can be depended on at all times.

The machine is kept in operation by winding a motor once a day; it is operated by 20 cells of Gassner's dry battery, arranged in three circuits, which are sufficient to do continuous work for over a year. The record roll carries enough paper to last several months, about 18 inches being fed out during a watch of four hours. The locking of the needle also arrests its side swing, thus reducing to a minimum what is technically known as the heeling error.

The machine enables the captain to keep a strict watch on the work of the man at the wheel, and to impel the latter to a greater exactness in the performance of his duty because he realizes that the record will be against him even if the bell is not heard. It is the opinion of many sea captains who have carefully examined this apparatus that its introduction must result in a saving of coal and time, as the course is held more accurately, and the errors seen can be allowed for every watch. To the underwriters it adds another feature of safety, which will be shared by all who take passage in ocean steamships.

Our illustration, Fig. 2, shows the compass and recorder temporarily mounted on a board provided with casters, as exhibited at the Maritime Exhibition.

Duplex Telephony.

BY JOHN A. BARRETT.

Taking the occasion of a recent Patent Office decision awarding to Dr. Rosebrugh, of Toronto, certain claims upon a method for duplexing telephone circuits, and your recent description of the details of this method, I suppose that a brief statement of some of the principles involved in the duplex systems so far proposed, and a review of the state of the art as it stands at present, will not be uninteresting.

There has been publicly offered no reasonable method for multiplying the number of telephone communications upon a single line, as is done in telegraphy. That involves a controllable differentiation of the individual impulses or groups of impulses which constitute the transmission, and the nature of the electro-telephonic vibrations is such as to have successfully precluded hitherto any analysis of these vibrations into their elements with subsequent synthetical rearrangement into intelligible speech. Consequently the problem has narrowed down to somewhat restricted limits both in respect to the methods employed for advantageous results, and in respect to the commercial usefulness of the most perfect results which may be secured. And this limitation has apparently been accepted by those who have made any degree of progress in the work.

It remains then to consider the problem only within these limitations, namely, the possible differentiation of circuits by which, in a system of circuits, any one portion of the system may be occupied simultaneously as a common branch by two or more, otherwise independent, circuits.

The commonest illustration of differentiated circuits lies in the single wire and earth return system of both telegraph and telephone lines. Here is a true duplex which allows of using one wire where it was originally supposed that two would be required. But while the common return by the earth serves perfectly the exigencies of telegraphing, it is beginning to be recognized that the more sensitive telephonic instrument ought to be secluded from the disturbances incident to grounded circuits, and a recurrence to the aboriginal principles of double wire circuits is rightly looked to as an impending necessity in the telephone business of the future. In fact, the metallic circuit system is already an essential feature of long-distance telephony.

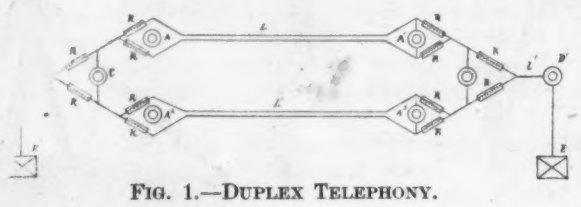


FIG. 1.—DUPLEX TELEPHONY.

Now it is evident that to abandon the earth return and to employ an independent wire return to each circuit means commercially the cost of two wires where one has served before, and herein practically lies a statement of the problem and the inducement: to arrange a system of circuits which shall secure the advantages of independent metallic circuits with the least multiplication of wires.

Perhaps the most obvious arrangement is to substitute the earth return by a thick wire common return for a group of several outgoing lines. This has been both suggested and employed in various instances with varying degrees of satisfaction. Derived in a measure from this is a proposal to bunch the termini of several lines all together, so that the return for any one circuit is scattered through all the other lines of the group. Such plans as these work fairly well under specially favorable conditions, but they have not recommended themselves to general adoption, the principal drawback to them being mutual interference between the wires of the group, due both to induction and to direct contact.

Another class of arrangements of more interest, because having apparent possibilities of greater usefulness, especially upon long circuits, are those in which each complete metallic circuit is again used as a portion of some other circuit. There have been a number of methods proposed for accomplishing this result.

The general principles of this class of duplex circuits will be readily perceived from the diagram, Fig. 1. This represents the so-called "bridge method" of duplexing, and it is evident from an inspection of the circuits that the bridge coils R may be so adjusted, with respect to the conditions of the lines, that the telephone circuits A, A^1, A^2, A^3, will be practically free from interference with the telephone circuit C, C^1. Such a system of circuits may be carried out to a wider range of grouping, observing always that if metallic circuits exclusively are provided for, there will be only one circuit less than the number of wires used in the combination.

It will be observed that, to whatever extent this system is carried, there is only one circuit less than the number of lines, while all are strictly metallic circuits.

Another method of superimposing the currents of a second circuit upon the branches of the primary metallic circuit, so as to produce no interference between the transmission of the two circuits, is by means of differential induction coils placed in circuit, substantially as in Fig. 2; so that while the currents of the primary telephones circulate normally through the two branches of the primary metallic circuit, the currents of the secondary telephones, operating differentially upon the induction coils, produce no disturbance within the circuit of the primary telephones.

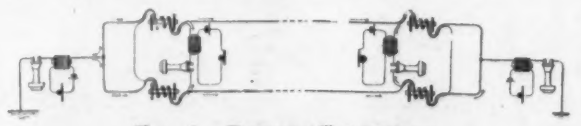


FIG. 2.—DUPLEX TELEPHONY.

Various interesting modifications of the induction balance method have been made, but a more promising plan than either the bridge or the induction balance appears to be the use of differential coils upon the telephonic receivers of the interior circuits, since, by this simple means, any receiver may be made normally in line to its own circuit, while all superimposed currents pass through it differentially and without disturbance.

By any of these devices, within a limited range of conditions reasonably good, results may be secured for increasing the carrying capacity of telephone circuits without recourse to the earth. But it is evident that the inevitable complexity of the circuits puts them all at once out of the way, so far as local telephone service goes, without taking account at all the unfavorable mutual inductive relations which such circuits would have.

The conditions of trunk line service, however, would seem to offer attractions for the introduction of some modification of these differentiated circuits, and this consideration has no doubt been the cause of inducing much labor in this field of invention.

For such as are interested in this work I would call the attention to a patent issued in this country to Mr. Frank Jacob, No. 287,288, Oct. 23, 1883, in which it is clearly stated that "the principles of his system are fulfilled whenever two wires are used as a single metallic circuit and the pair again used as a single line forming part of another circuit."

Throughout his specifications and in his first claim he designedly avoids specific reference to details of construction, but covers broadly the general principles of any such grouping of the circuits, so that all modifications of detail, however ingenious and useful, must stand subordinated to the Jacob patent, so far as they depend upon the double use of the circuits which he describes.

Besides this, there are several practical difficulties to be encountered in adapting such methods to the conditions of actual service. First, there are troublesome complications in switchboard connections for the operation of such circuits. Then is introduced the delicate adjustment of the means for accurately differentiating the circuit, with possible variations required for meeting the variable conditions of the lines. In addition, there is the fact that the external instruments are required to work through all the accumulated resistance of the coils of the interternal circuits with a material loss of force. And, more important and objectionable than all the rest, are the bad inductive relations which exist between the respective circuits made up in such groups. These relations introduce cross-talk between different lines, which it has been very difficult to banish from even the simplest of metallic circuits.

Such difficulties as these, together with the existence of the Jacob patent, will sufficiently answer the question which has been often asked—why no use has been made of some of these duplex methods which have from time to time been brought forward. As a general conclusion, it may be stated, that irrespective of the Jacob patent, no one of the methods above described has been brought to such a state of perfection as to be suitable for more than a limited application to existing telephone business.

There is one class of service, however, in which any one of these devices might be usefully employed; and that is, where it is desirable to combine a trunk line telephone with a telegraph system. In such a combined system it is perfectly practicable and advantageous to use each simple metallic line as a separate telephone circuit, and then to use each metallic pair again as a single and entirely independent telegraph line with ground return. Such use of the doubled lines for telegraph circuits would not interfere in the slightest degree with their serviceableness as telephonic metallic circuits, but the method would necessarily be employed subject to a license under the Jacob patent.

Some other methods which have been proposed for the double use of a pair of wires, both as a simple metallic circuit and as a portion of a second circuit, are interesting chiefly as evidences of great ingenuity; but since they generally fall even farther away from practical service on account of the greater limitation to their usefulness, I will not here give a description of them.

To those who may possibly have use for a more detailed study of the subject, I offer the following list of patents as embodying the most of what has been done in this line of invention:

F. Jacob, Electric Conductor; No. 287,288, Oct. 23, 1883.

J. J. Carty, Telephone and Telegraph Circuit; No. 348,512, Aug. 31, 1886.

John A. Barrett, Telephone Circuit; No. 350,715, Oct. 12, 1886. [See THE ELECTRICAL WORLD, Oct. 23, 1886.]

A. M. and T. R. Rosebrugh, Multiple Telephone; No. 417,511, Dec. 17, 1889. [See THE ELECTRICAL WORLD, Jan. 4, 1890.]

The Effect of Electromotive Force.

To the Editors of The Electrical World:

Will you kindly inform me, through the columns of your paper, whether the total E. M. F. of an electric current is supposed to pass through the first of several lamps in series? For instance, in a series of five 20-volt lamps on a 100-volt circuit, the E. M. F. of the current, after passing through the first lamp, is 80 volts; after passing the second, 60 volts, and so on, thus reducing the potential of the current by just 20 volts for each lamp it passes through. Consequently, can it not be said that, while only 20 volts were consumed in each lamp, yet the entire 100 volts passed through, or were transmitted through, the first one?

NEW YORK CITY. EDWARD HEATON.

ANSWER.—While it would be permissible to employ the expression that the *current* had passed through each lamp of the series in succession, it is entirely improper to say that the E. M. F. had passed through each. The current is the result of the E. M. F. maintained, and hence each lamp of the series is entirely independent of the other, so far as the E. M. F. at its terminals is concerned. Hence, even if it were proper to use the expression employed by our correspondent, it could not be considered that the total E. M. F. of 100 volts in any way affected any single lamp.—EDS. E. W.

Edison Isolated Plant in the Talbot Mills, North Billerica, Mass.

One of the greatest difficulties which electrical engineers have to meet in the installation of electric light plants in the factories in New England is due to the fact that many of these mills are driven by water power. Water wheels, do not, as a rule, from the nature of things, regulate as closely as can the modern steam engine, and, therefore, the electrical engineer is confronted at the outset by a possibility of more or less radical changes in the speed. Some eight years ago the Edison Company met this problem by the invention of an automatic regulator outside of, and independent of mechanical connection to, the dynamo. Knowing the interest that is attached to this subject among manufacturers, we publish this week a description of one of the most recent plants installed by Paine & Francis, the agents of the Edison Company in New England, at the Talbot Mills in North Billerica, Mass., one of the finest woolen mills in the country.

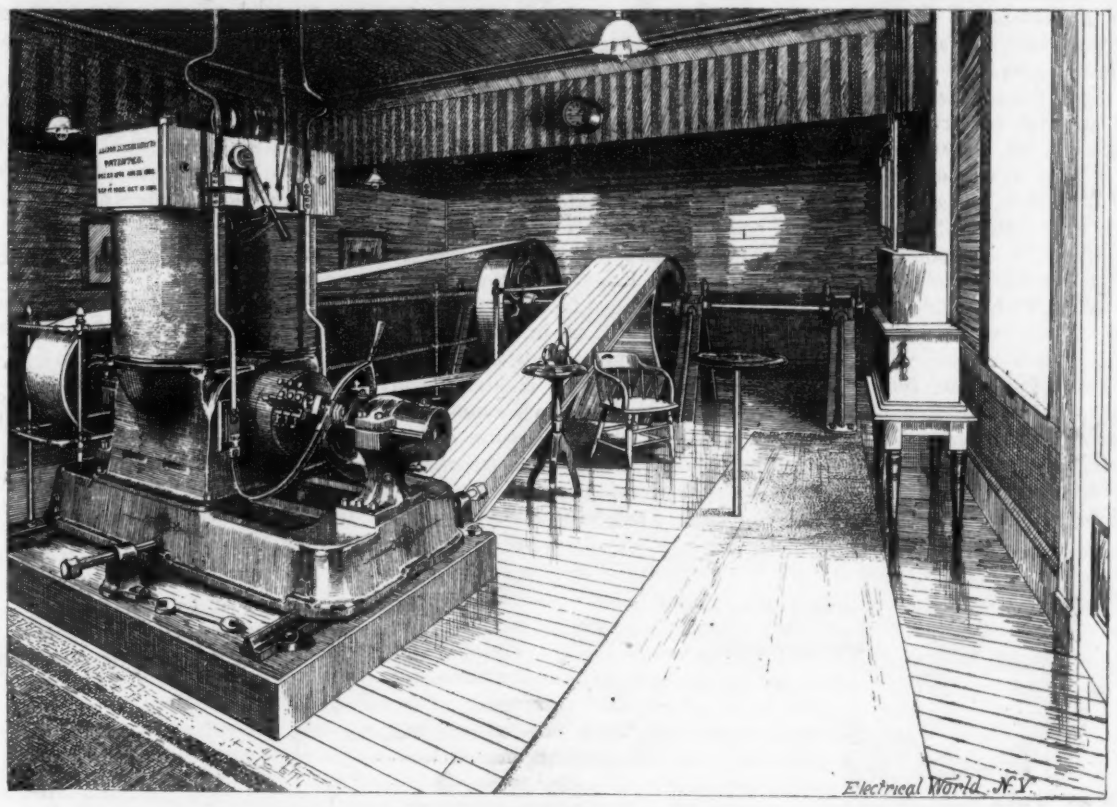


FIG. 1.—EDISON ISOLATED PLANT, TALBOT MILLS, NORTH BILLERICA, MASS.

The electrical plant consists of one 900-light shunt-wound Edison dynamo, with 800 lights, installed throughout the premises. This dynamo is driven by a special water wheel manufactured by the Rodney Hunt Machine Company, of Orange, Mass., controlled by a special water wheel governor, and inasmuch as no other work is performed by the wheel the problem becomes still more interesting. The dynamo is located in a room about 100 feet from the mill, the water wheel being in the basement. From the water-wheel shaft an inclined belt is carried to the room above, where the dynamo is situated, driving a countershaft, from which a horizontal belt drives the dynamo.

The peculiar interest attaches to the automatic regulator which, as seen in the cut, is placed upon a shelf at one side of the room. This automatic regulator consists of a rheostat, the arm of which is operated by two sets of vertical magnets. The coils of the rheostat are connected directly in the field circuit of the dynamo. Upon the top of the rheostat box is placed a pair of horizontal magnets which are connected in shunt to the main circuit by pressure wires running back from the centre of distribution. The pressure at the horizontal magnets is therefore the same as at the lamps. The pull of the horizontal magnets on the armature is offset by a spiral spring, and to this armature is attached a vertical arm which plays between two contact points. The pressure at the lamps is adjusted by means of the spiral spring, so that when the lamps are at candle power the pull of the magnet is exactly equal to the power of the spring, thus holding the vertical arm midway between the contact points. Should the speed of the motive power increase, the first effect is to increase the E. M. F. at the centre of distribution, and the horizontal magnets thus becoming stronger than the spring, the vertical arm is pressed against one of the contact points and a circuit is established about one set of the vertical magnets which control the arm of the rheostat, resistance being thus automatically inserted in the field circuit, decreasing the pressure at the centre of distribution to normal.

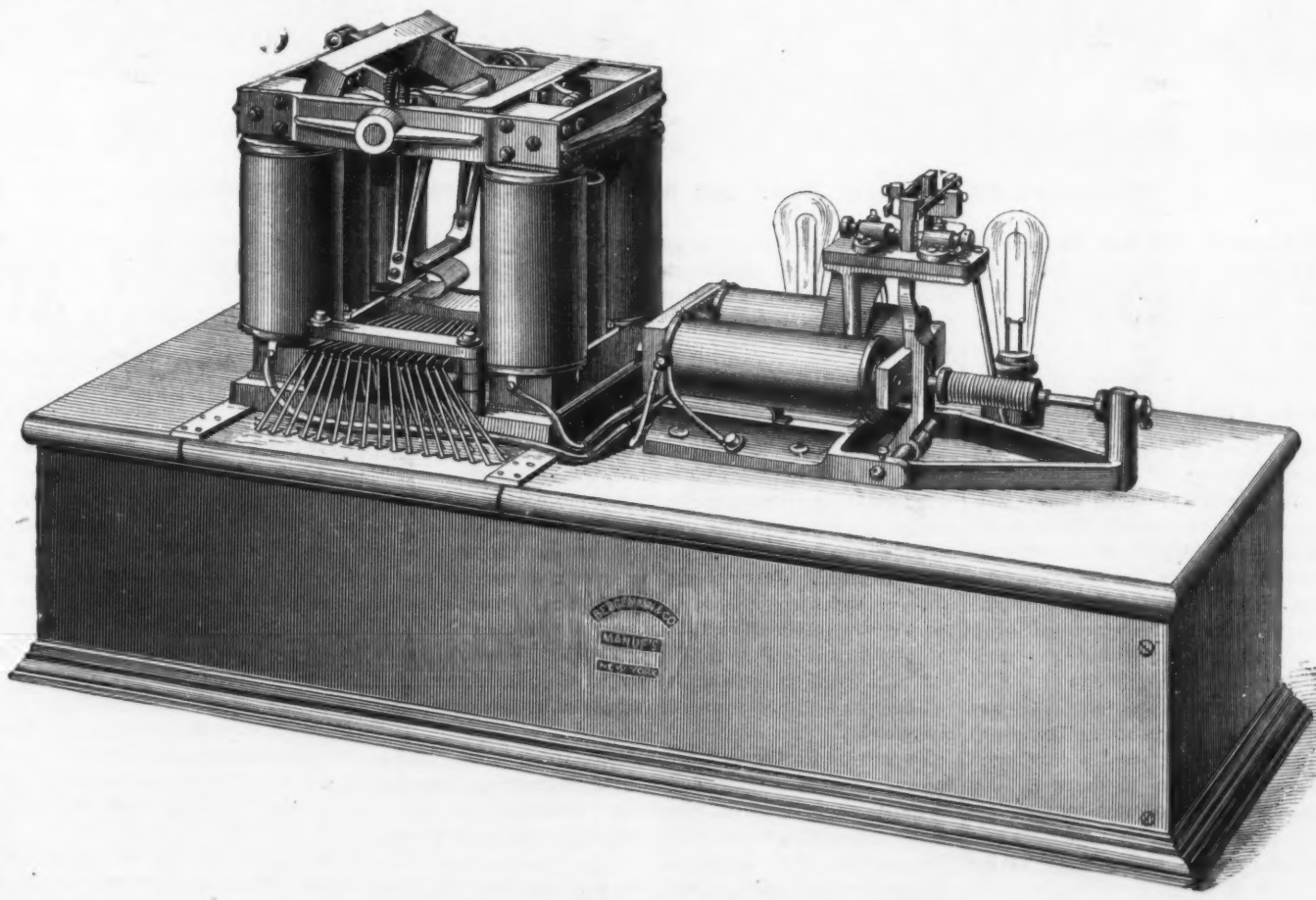


FIG. 2.—EDISON AUTOMATIC PRESSURE REGULATOR.

Should the speed of the motive power decrease, the strength of the horizontal magnets is diminished, and the strength of the spiral spring throws the vertical arm against the other contact point, and the circuit is established about the second set of the vertical magnets working the rheostat arm, and resistance is thus automatically thrown out of the field circuit, increasing the E. M. F. at the centre of distribution to normal. By the side of the horizontal magnets are two lamps, one of which is thrown into circuit automatically if the strength of the current is increased, and the other if the strength of the current is decreased. When the current is normal neither lamp is burning. These two lamps thus serve the purpose of a pressure indicator.

The automatic regulator also performs the function of maintaining a uniform pressure at the centre of distribution, if, for any reason, the number of lamps in circuit is decreased or increased, thus tending to increase or decrease the E. M. F. to normal.

The shunt-wound dynamo, governed by an automatic regulator, performs not only the functions of a compound wound machine in its regulation for a variable number of lamps in circuit, but also regulates as well for a variable speed in the motive power, which cannot be done by a compound-wound machine.

The effectiveness of the automatic regulator as described above, is well illustrated by an incident which occurred a few weeks ago at the Talbot Mills. The water was so high in the race that the speed of the wheel was reduced so as to bring the speed of the dynamo from its normal (700 revolutions per minute) to 400 revolutions per minute, and the automatic regulator kept the candle power of the lamps at normal through all these changes.

The wiring of this plant has been done in such a way as to bring a uniform brilliancy to all the lamps throughout the premises, regardless of the number of lamps burning. There is a set of main feeders running from the dynamo to the centre of distribution; from this point main wires run to the different rooms, and from these points sub-main circuits are carried to the lamps. There are some forty of these sub-main circuits, each one being controlled by a separate switch placed in the room with the lights, so that each foreman can control the lights of his own department.

The endeavor of the contractors has been to make this a model New England plant, it being well supplied with ampère meter, dynamo switchboard and all the modern appliances. The lamps are so arranged as to light each set of machines perfectly independent of any other set, and the plant has been thoroughly inspected and commended by the inspectors of the Factory Mutual Insurance Company.

The arrangement of the motive power of the plant has been under the personal supervision of Mr. W. H. Sheldon, of the Talbot Mills, and reflects great credit upon him as being an ingenious piece of work. Everything has been so arranged that the entire electrical and power plant may be controlled in the dynamo room, a vertical shaft with hand wheel leading from the dynamo room to the gate in the wheel room below. The dynamo room has been tastefully finished in hardwood sheathing, producing a very handsome effect. Paine & Francis and the Talbot Mills are to be congratulated upon the thorough and effective manner in which the whole of this installation has been carried out

Why a Man Should Wear Copper Brads.

We feel we should be wanting in a sense of public duty if the following were withheld from electrical people suffering from any of the ills that flesh is heir to. The St. Louis *Republic* is the source:

"Do you see these large copper brads in the sole of my shoe?" asked a gentleman, as he held up to view the sole of one of his shoes. On being assured in the affirmative, he said: "To those simple brads alone I attribute my present good health. For years I was an invalid, subject to dyspepsia, neuralgia, headache, and other innumerable pains, and traveled the country over in search of health.

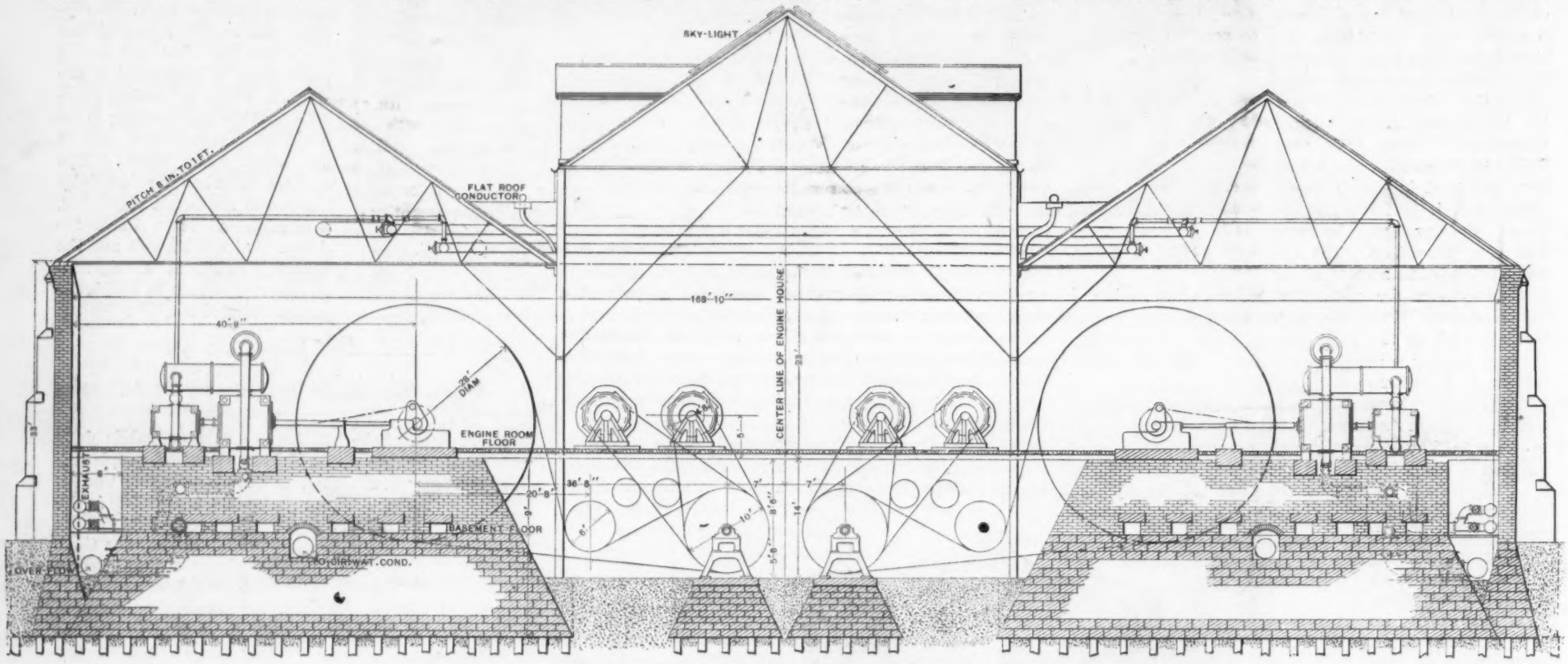
"I sought an explanation of the matter, and by continued observation and study was finally led to the conclusion that the aches and pains to which civilized man is heir are owing to the manner in which we insulate our bodies from mother earth. Science is every day more clearly demonstrating that electricity is the vitalizing constituent of our bodies, and that this globe of ours is a mighty battery, continually generating and discharging electricity. Now, I reasoned, if this was correct, the secret of the indian's health was in his bare feet, which exposed his whole body to the vitalizing influence of the electrical earth currents; while my ill health was attributed to my feet being insulated from these currents. Acting on this hypothesis, I sought to restore the broken connection by inserting these brads in the soles of my shoes, and the result, I must say, was astonishing. My feet, which formerly were nearly always cold, soon became

warm and moist; my health began shortly to improve, and in a few months I was entirely relieved of all my pains and have ever since enjoyed good health. It is a very simple thing and easily tested, and I feel sure would benefit any one afflicted as I was."

The New West End Railway Power Plant in Boston.

We illustrate on this page, in elevation, the new permanent power station which the West End Street Railway Company are erecting on the site of the locomotive works recently acquired by them for the purpose. We are indebted for the cut to the *Street Railway Journal*.

The idea is to have this plant, as regards size, excellence and adaptability for its work, excel any yet constructed. The aggregate capacity of the engines will be 13,000 h. p. These, which are being built by E. P. Allis & Co., of Milwaukee, Wis., will be 13 in number, of 1,000 h. p. each, of the Reynolds-Corliss triple expansion type with condenser. The three cylinders measure, respectively, 21, 36½ and 52 inches in diameter with a 42-inch stroke. The flywheel, which is 28 feet in diameter with a 10-foot 7-inch face, and weighs 60 tons, will make sixty-eight revolutions per minute. Each engine will drive, by means of two belts, each five feet wide, four specially-designed multi-polar Thomson-Houston generators of about 200,000 watts capacity each, compound-wound, four-pole, with Gramme ring armatures. These armatures are nearly five feet in diameter, with 6-inch shafts, and will make 400 revolutions per minute. The



ELEVATION OF THE NEW WEST END RAILWAY POWER PLANT, BOSTON, MASS.

boilers, engines and smoke stack will rest on granite foundations supported by about 700 piles 45 feet long. The stack will be 250 feet high, circular in form, double brick shell, 26 feet diameter at base and 17 at top, with a flue of a uniform diameter of 13 feet.

Important Clauses In Wiring Specifications.

The architects in Boston have adopted the following clauses in their wiring specifications:

Conduits.—All electric light wires are to be placed in a moisture-proof insulating tube or conduit. These tubes must be of sufficient size and so placed that the wiring may be withdrawn and replaced at will. A separate tube must be laid for each wire, except in case of "taps" for not more than fifteen ampères, in which case conductors having only a cotton insulation separating them will be required.

Cut-outs and Junction Boxes.—The mains are to run to main line junction boxes, which are to contain porcelain cut-outs with safety devices. Branch junction boxes are also to be used throughout the building, and so arranged that cut-outs can be placed in them if desired. All switches and cut-outs must be made of non-combustible material.

Wiring.—Separate sets of vertical mains must be installed for each floor; the ends of these feeders must terminate at the switchboard if the dynamos are placed in the building, or, if the current is supplied from outside, at the point of entrance.

At all outlets to and from cut-outs, switches, fixtures, etc., wires must be separated from gas pipes or any other part of the building by insulated tubing, and must be left in such a way as not to be disturbed by plasterers.

The wiring in the building must be so calculated that there will be no loss greater than three per cent. for the total number of lamps to be supplied.

Wires must have a non-inflammable insulation covering, and must be flexible.

If no gas pipes are installed at the outlets, an approved substantial support shall be provided for the fixtures.

The wiring, when completed, must in every case pass the inspection of the Boston Board of Fire Underwriters or the New England Insurance Exchange.

The Electrical Industry In the Eleventh Census.

As we have already announced, Mr. Allen R. Foote, of Cincinnati, has been appointed special agent for the collection of data relative to the electrical industry for the eleventh census, about to be begun. In a circular recently issued by Mr. Foote the aims to be elicited are very forcibly brought out as follows:

The investigation of the electrical industry, to be reported in the eleventh census, offers an opportunity of great value to ascertain the true importance that the practical application of electric energy has acquired in industrial and social development. This opportunity should be made use of to the fullest extent possible. In all departments of endeavor, an exact knowledge of existing and antecedent conditions is the necessary base from which to direct future action. Laws and actions based on assumptions instead of ascertained facts are the pitfalls of civilization. He whose action is not in accord with fact, though it be unknown to him, must pay the penalty of ignorance through the loss caused by his inevitable error. A business policy guided by ascertained facts cannot fail.

Some managers of electric lighting and power stations have intimated to me that there are certain features of their business concerning which they do not desire to answer inquiries. They have acknowledged at the same time, however, that information regarding those very points, if given by other companies, would be more valuable to them than any other data that can be obtained. So strong is the repugnance of some persons to the invasion of what they consider their private affairs, that sworn agents of the census frequently find it difficult to obtain the information to which they are legally entitled. I believe the policy of secretion on the part of any individual to be a mistaken one, adopted either under a misapprehension of the facts or an ignorant view of his own interests.

Information given to any agent of the census cannot be used to the injury of the giver. The interest of the government can be served only by protecting the interest of the individual. Every agent is sworn to secrecy and is under as strict supervision as the National Bank Examiners. Every publication of the information obtained is absolutely impersonal, so that it cannot possibly be traced to any individual or company unless it should happen that but one person or company is employed in the occupation described.

To provide for the lack of uniformity in accounts and to inform all persons interested as to what inquiries they will be expected to answer, schedules are furnished months in advance of the date on which the information is wanted. This enables each concern so to keep account of the items that on the day from which the information must bear date an accountant can easily fill up the entire schedule and mail it to the census office. The advantages to be gained by individuals and companies in doing this are a most generous return for so simple and easy an undertaking on their part.

The lack of information that may be obtained through the census report has been felt so keenly that no less than ten individual attempts by as many central station companies to gain some part of it have come under my observation during the year 1889. These attempts have been expensive to their originators and troublesome to those to whom they have made their appeals. Worse than this, they have been unsatisfactory, because too limited in the scope of their inquiries, and dangerous because they have not covered all the factors necessary to a correct statement. Public or private action based on insufficient data can but be ill-advised and disappointing. Such disadvantages may now be overcome with the greatest ease, to the injury of none and the advantage of all, if each person in interest will promptly and fully supply his own quota of census data.

The report of the investigation with which I am intrusted will be the first official chapter in the history of the practical application of electricity to the uses of light and power. I do not assume the ability to write a report that shall be perfectly satisfactory to the 65,000,000 critics in the United States, not to mention those in foreign countries, to whom my work must be submitted. What I shall do is to give every person who may criticise me adversely, *after* my report has been published, a good opportunity to place himself on record by making suggestions to me while the work is in condition to be benefited by them.

In my opinion, the facts to be reported form two distinct classes:

First, Facts of present value, the full benefit from which will be realized at the time of publication.

Second, Facts having a future value, the full benefit from which will be realized ten years hence when comparisons are made between the results shown by the eleventh and twelfth censuses.

There are a multitude of facts of very great value to those directly interested in the industry, that have no value to the general public, except in an indirect manner. The collection of such facts will be limited by the voluntary co-operation of those to be benefited in supplying them.

The Stanley Constant-Current Alternating Machine.

With the constantly increasing application of the alternating system, and its adaptation to all purposes for which the continuous current is employed, it is evident that a constant-current alternating machine will find more than one application. The problem involved in the construction of such a machine is the providing of means by which the alternating current generated by the machine shall remain constant under all loads; or, in other words, by which the potential generated shall be approximately proportional to the load. This has been accomplished in an alternating machine by Mr. Wm. Stanley, Jr., whose work in this field is already known to our readers. The engraving, Fig. 1, page 45, shows the machine in outline, from which it will be seen that it does not differ essentially in form from the alternating machine already in existence. The field magnets of alternate polarity, *N*, *S*, are excited independently, and the armature has polar projections with laterally projecting lugs.

The essential feature of the construction lies in the nature of the windings on the armature poles. These coils consist of many convolutions, so that a slight variation in the quantity of current flowing through the coils produces considerable variation in the ampère turns.

In the operation of the machine, according to the inventor, the strong field magnets tend to develop a large number of lines of force, and the alternate currents generated tend to set up in the armature core lines of force which oppose or stem back a portion of the lines of force of the field magnet pole toward which it is moving, thus permitting only a comparatively few to be effective in generating an electromotive force in the armature coils. These two tendencies to establish lines of force may be considered as the magnetic potentials of the field and armature. The excess of the mag-

netic potential of the field above that of the armature at the time when the field poles are effective in sending lines of force through the armature core is that which is effective in producing electromotive force in the armature coils. The number of lines of force resulting from this difference of magnetic potentials, and which are thus effective in developing current in the armature coils, will remain approximately constant so long as the resist-

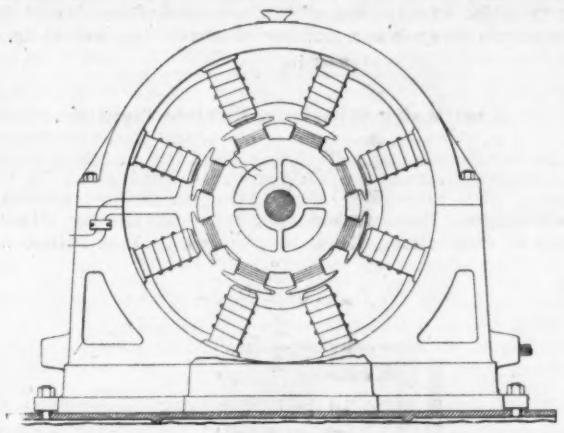


FIG. 1.—STANLEY'S CONSTANT-CURRENT ALTERNATING MACHINE.

ance offered to the flow of the current on the work circuit remains constant; but as the resistance increases, the tendency of the armature current to be diminished will allow a greater number of lines of force to cut the armature coils, thus increasing the electromotive force sufficiently to hold the current approximately at a predetermined value.

In practice there is a slight decrease in the current unless certain compensation is secured by other means. The shifting of time of development of maximum polarization of the armature with reference to the passage of the armature poles across the field magnet poles, by changes in the resistance of the armature circuit, is effective in producing the compensation; and in practice such shifting may be made of sufficient effect as to render the current very nearly constant in value.

In order to obtain the full effect of the counter influence of the shifting of time of maximum magnetic potential of the armature, the lateral flanges or lugs are provided. These encompass such a portion of the armature periphery as to afford a more or less perfect path for the lines of force of the field magnet from one pole to its neighbor when in certain positions of the armature, as shown in Fig. 2. It is evident that by this construction a less displacement of the phase of the armature magnetization is necessary in order to produce the required opposition to the field magnetic potential to stem back the lines of force and prevent them from threading the armature coils.

In practice Mr. Stanley has obtained excellent results by employing a field magnet with eight poles and with a cylindrical opening $15\frac{9}{16}$ inches in diameter and 11 inches in length, the core projections being about $3\frac{1}{4}$ inches thick and having their ends beveled, the width of the face between the edges of the bevels being $1\frac{1}{4}$ inches. These poles are each wound with 588 turns, making a total of 4,704 turns. The size of wire is No. 11. The armature is also made with eight poles, and is $10\frac{1}{4}$ inches in length and $15\frac{5}{8}$ inches in diameter. The width of the pole cores is 3 inches and the lugs project one inch on each side, making the total width 5 inches. The poles are wound with seven layers of No. 16 wire, 23 turns per layer.

This machine was run at 1,425 revolutions per minute, and with a current of $5\frac{1}{2}$ to 6 ampères in the field-magnet coils yielded 9 or $9\frac{1}{2}$ ampères at an electromotive force of 3,800 volts.

Tests on the Efficiency of Westinghouse Converters.

BY N. MARSHALL.

The following account of tests made at the Massachusetts Institute of Technology, under the direction of Prof. Charles R. Cross, we believe will be of general interest to the readers of THE ELECTRICAL WORLD, as these tests were made with great care, and are believed to be quite accurate. They agree to a fraction of a per cent. with tests made on the same converters by different observers and by an entirely independent method. A description of the method employed will be given first, then a description of the apparatus, and the results of the tests will be given finally.

Method.

As all the methods employing electrometers seemed to be very unsatisfactory, a calorimetric method was employed in making these tests, two calorimeters being used, one an ice calorimeter to measure the loss due to conversion and a water calorimeter to measure the output.

When measurements were not being made on the output, it was expended on a bank of lamps adjusted so that the same current would pass through them as through the coils of the water calorimeter; this adjustment was made and maintained by means of a Thomson-Houston current indicator. The change from lamps to calorimeter was effected by means of a commutator and occupied an inappreciable time. Potential was observed by means of a Cardew voltmeter. In making a test the procedure was as follows:

The converter, stripped of its outside casing, was placed in the inner compartment of the calorimeter, the wire led out and all joints made secure against leakage. The calorimeter proper was then packed with ice, its cover was put in place and ice put around the whole, this ice being contained in a non-conducting box, and serving simply as a jacket. When the packing was complete the apparatus was covered and left to stand over night in order to allow all parts to become thoroughly cooled and to assume a uniform temperature of 0 deg. Cent. The next morning the rate of drip from the calorimeter was observed, this observation being taken to allow for melting due to the heat of the room. The current was then turned on for eight hours; during this time frequent observations were made on the rate of output, which was maintained as constant as possible. These observations were conducted as follows:

The temperature and weight of the water in the small calorimeter were noted, the current was then shifted from the lamps to the calorimeter and the time observed to obtain a given rise of temperature, as the current was the same as that through the lamps; these observations gave a means of computing the output. At the end of the eight hours the current was shut off and the apparatus allowed to stand until the rate of drip was the same as at the start; this was generally for about 48 hours after the current was turned off. When this rate was attained it was assumed that the converter was again at 0 degrees centigrade. The test was then stopped and the water collected from the melted ice and weighed. This gave, after the correction for the atmospheric melting had been applied, a measure of

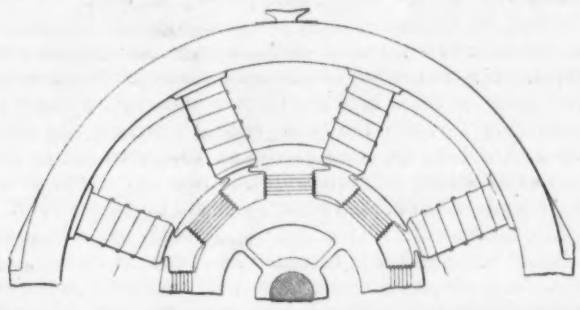


FIG. 2.—STANLEY'S CONSTANT-CURRENT ALTERNATING MACHINE.

the loss due to conversion. Having the output, we are able to calculate the efficiency.

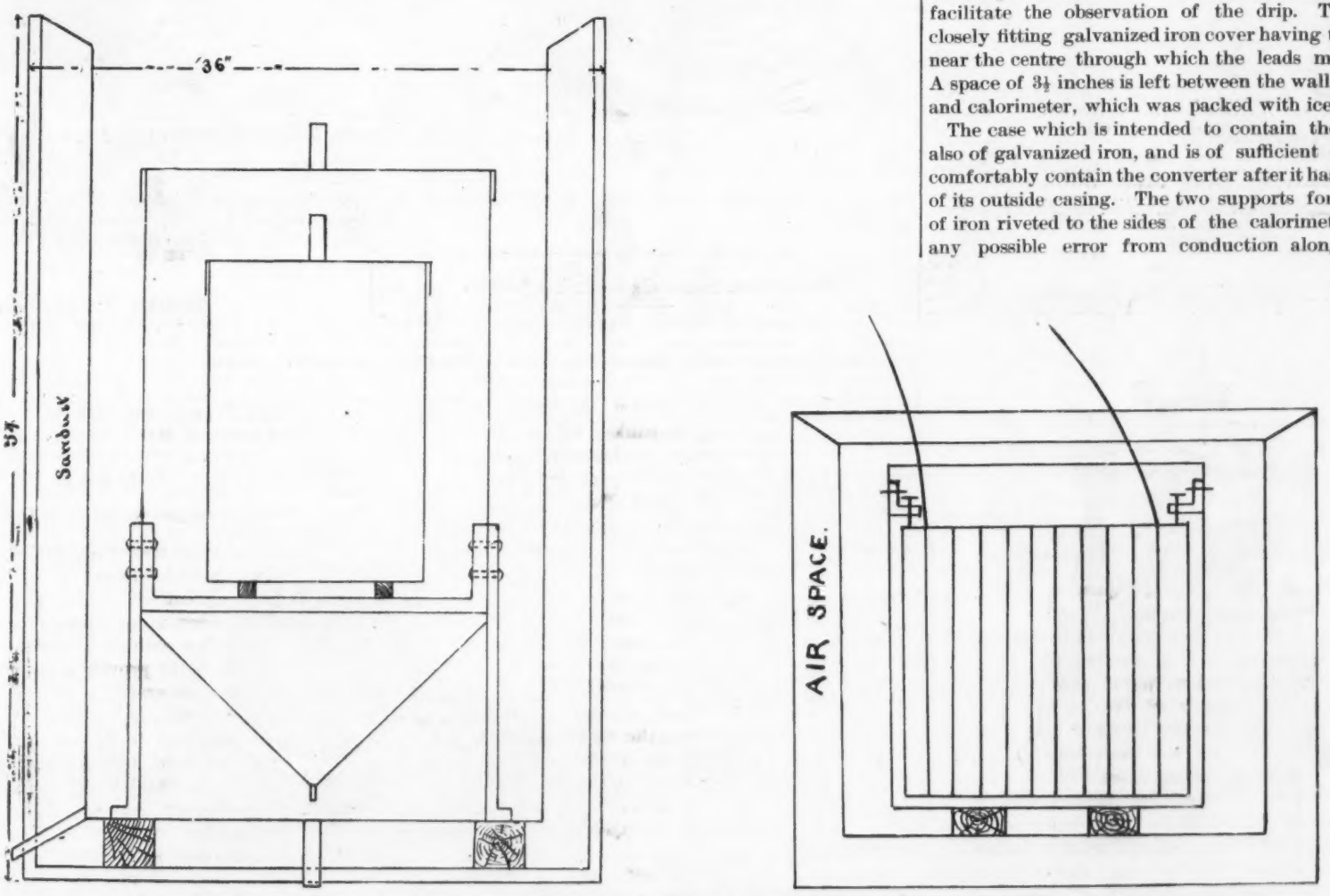
Description of the Apparatus—The Ice Calorimeter.

The ice calorimeter is made of three separate boxes or compartments, all the details of which are given in the accompanying diagrams, Fig. 1.

The outside box is built of $1\frac{1}{4}$-inch boards lined on the inside with tin, with an intervening space of three inches closely packed with sawdust; this box serves merely as a jacket for the calorimeter.

In order that all the water resulting from the melting of the ice may be collected, the sides of the calorimeter box proper are brought to a point, the slope making an angle of about forty-five degrees, terminating in a pipe one-quarter of an inch in diameter. A rubber tube is fitted over this pipe and led through a hole in the bottom of the jacket. To prevent the warm air outside from passing up through into the calorimeter, the tube was allowed to sag and form a U-trap. The tube was furnished with a glass nozzle to facilitate the observation of the drip. The box has a closely fitting galvanized iron cover having two short pipes near the centre through which the leads may be carried. A space of $3\frac{1}{2}$ inches is left between the walls of the jacket and calorimeter, which was packed with ice.

The case which is intended to contain the converter is also of galvanized iron, and is of sufficient dimensions to comfortably contain the converter after it has been stripped of its outside casing. The two supports for this case are of iron riveted to the sides of the calorimeter, to prevent any possible error from conduction along these. Two pieces of wood are interposed between the supports and the case. A galvanized iron cover, similar to the other, completes the ice calorimeter. A space of about six inches is left between the case and the inside box, which is also packed with ice.



FIGS. 1 AND 2.—TESTS ON THE EFFICIENCY OF WESTINGHOUSE CONVERTERS.

The Water Calorimeter.

The water calorimeter is of tin and made in the form of a cylinder and contains a little over 13 kilograms of water. It is placed in a larger tin cylinder with an air space of four inches, as shown in the illustration, Fig. 2. The calorimeter rests on blocks of wood to prevent conduction.

The tin used in making the calorimeter is as thin as possible and the water equivalent is therefore negligible. The wire of the coil is of German silver wound about a wooden frame, the frame itself being held in position by clamps fastened to the sides of the calorimeter. The water

was kept in constant circulation by stirring and the mean temperature was maintained as nearly as possible at the temperature of the room, so that on account of the large amount of water used, the cooling temperature correction is about one-tenth of a degree an hour and is therefore negligible as the tests on this calorimeter were only ten minutes long. The temperature readings were taken with a very sensitive centigrade thermometer graduated to tenths of a degree.

Calibration of the Calorimeter.

The ice calorimeter was calibrated by placing a German silver coil in the casing and passing a direct current through it; the current and potential were read by means of Thomson's stage instruments, and were maintained constant. The calibration test lasted eight hours, the current and potential being kept at such values that the number of watts put through the coil should generate the same amount of heat (approximately) as was given out by the converter during the regular test. Two such calibrations were made, and checked the calorimeter to one per cent.

The water calorimeter was calibrated by the same method and checked to three-tenths of one per cent. Any error in the ice calorimeter from water adhering to the ice was reduced to a minimum by allowing the calorimeter to stand a sufficient length of time before beginning and completing the test.

Test on Ice Calorimeter.

March 19, 1889.

Coil of German silver wire, resistance	3.11 ohms.
Current turned on	9h. 10m.
Current turned off	17h. 10m.
Test stopped, March 21	12h. 15m.
Drip at start, drops per minute	3.8
Drip at finish, drops per minute	2.7
Weight of ice melted (uncor.)	17,419 gms.
Drip correction	269 gms.
Weight of ice melted (cor.)	17,150 gms.
Heat units developed	1,372,000 gm. degs.
Average potential defl. 36.3 P., ¼ N. / Average current defl. 44.3 P., 1 N.	H = .1751
Number of heat units developed, as shown by Thomson inst's	1,357,776 gm. deg.

Check to 1 per cent.

A second run gave a check to 2 per cent., but owing to an accident was unreliable.

Calibration of Water Calorimeter.

March 13, 1889.

Temperature, start	9.9 deg. C.
Temperature, finish	13.6 "
Time run	10m.
Weight of water	13,322 gms.

Thomson Instruments.

Potential galv. defl.	22.90 P., 1.8 N.
Current " "	29.25 P., 1 2 N

Check to 0.3 per cent.

Test No. 1.

May 3, 1889.

20 ampère Westinghouse converter No. 4.

Current turned on	9 h. 10 m.
Current turned off	17 h. 10 m.
Test stopped, May 6	9 h. 5 m.
Drip at start, drops per minute	5
Drip at finish, drops per minute	1.75
Weight of ice melted (uncor.)	6,428 gms.
Drip correction	769 gms.
Weight of ice melted (cor.)	5,659 gms.
Calories lost	452,720
Weight of water in water calorimeter	13,656 gms.
Time of run in water calorimeter	10 m.
Mean rise of temp., water calorimeter	10.8 deg. C.
Total output in heat units	7,079,270 gm. degs.
Calories per minute	14,748.5
Efficiency	93.9
Lead	20 ampères, 50 volts.
Alternations	14,530 per min.

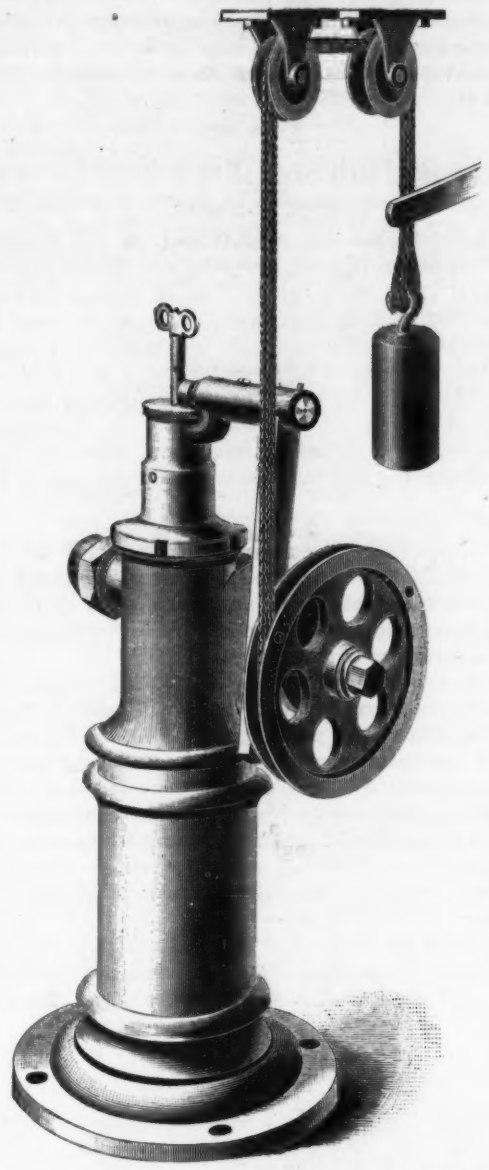
Test No. 2, May 7, 1889.

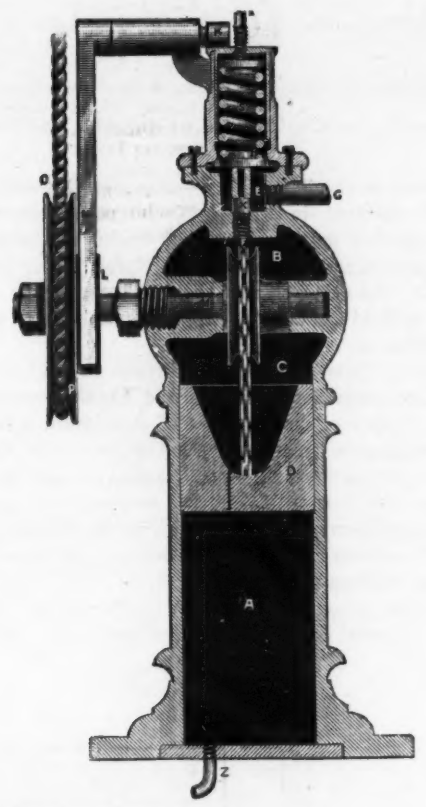
20 ampère Westinghouse converter No. 4.

Current turned on	9 h. 10 m.
Current turned off	17 h. 10 m.
Test stopped, May 9	11 h. 0 m.
Drip at start, drops per minute	3
Drip at finish, drops per minute	1.5
Weight of ice melted (uncor.)	6,671 gms
Drip correction	354 gms.
Weight of ice melted (cor.)	6,417 gms.
Calories lost	513,360
Weight of water in water calorimeter	13,656 gms.
Time of run in water calorimeter	10 m.
Mean rise of temp. in water calorimeter	10.7 deg. C.
Total output	6,867,602 gm. degs.
Calories per minute	14,611.9
Efficiency	93 per cent.
Load	25 ampères, 50 volts.
Alternations	14,840 per minute.

Memorandum.—During these tests the primaries of converters were in series with two 16 c. p. Sawyer-Man lamps, as the machine was run at a very high voltage for other work.

Note.—Tests were made at the same time of converters of the two other principal manufactures of alternating apparatus; the next highest efficiency to the Westinghouse was 84 per cent.





FIGS. 1 AND 2.—MASON STEAM DAMPER REGULATOR.

The Mason Steam Damper Regulator.

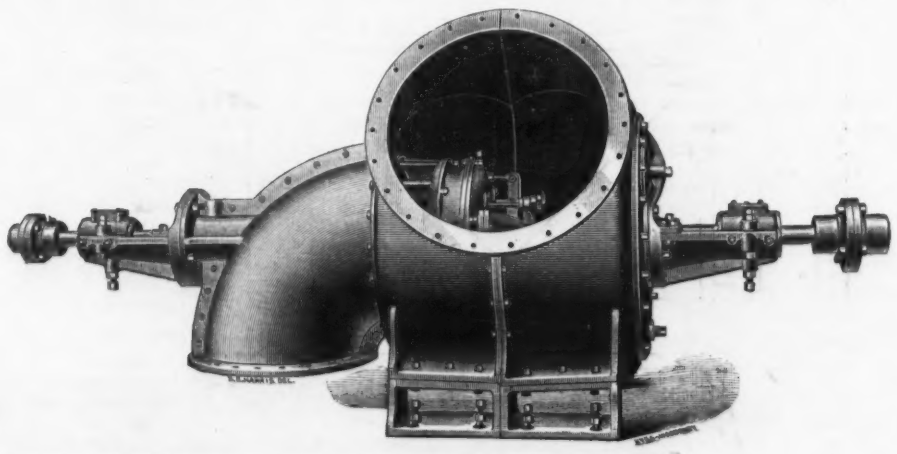
The accompanying illustrations represent an exterior and a sectional view of a novel steam damper regulator recently brought out by the Mason Regulator Company, of Boston. From the view, Fig. 1, it will be readily seen that it is only necessary to set the regulator in some convenient position and attach it by a chain to the damper, while a connection is made with the boiler by means of a small pipe. The pressure desired to be carried can readily be changed by turning the key shown at the top.

The practical working of the regulator is as follows: Referring to the letters shown on the sectional view, Fig. 2, it will be seen that the boiler pressure, which is connected at the pipe *C*, comes into the chamber *E*, the top of which is formed by a diaphragm, on which rests the main spring *S*. If the boiler pressure rises above the required point, or sufficiently to overcome the tension of the spring *S*, the diaphragm is raised very slightly, and the steam passes down the passage *X* to the upper surface of the piston *D*, which it forces down. This piston, being connected with the wheel on the shaft *H* by a chain or rack and pinion, turns it around, communicating a like motion to the outside wheel, and thence to the damper in the flue. When the boiler pressure falls, the diaphragm comes on to its seat, which covers the passage *X*, and steam pressure is removed from the top of the piston *D*, while the weight on the damper brings the wheel *P* back to its original position.

It is a general opinion among engineers that a regulator which suddenly opens or closes a damper to its full capacity wastes coal; therefore a device which is known as a compensating lever is provided in the lever *M* which rests on the cam *L*. As the shaft *H* turns, the lever is thrown over and works a cam, *K*, which changes the tension on the main spring, immediately the regulator commences to act. By this means it is found that the damper is kept more constant and the draft steady. The regulator is furnished either with or without the compensating lever, as desired. It is made throughout of the best steam metal, and the apparatus is in use in a number of electric light stations.

Hunt Water Wheels in Electric Lighting.

In an article on page 43 of this issue will be found an interesting account of the Edison electric light plant in the Talbot Mills, mentioning the fact that the power is obtained from Rodney Hunt turbines made by the Orange, Mass., firm of that name. As a supplement to that article we give therefore on this page two views of the turbine in question, and would refer our readers to the description of the plant for points as to the service rendered.



FIGS. 1 AND 2.—RODNEY HUNT TURBINES FOR ELECTRIC LIGHTING.

Smith's Wiring Dial.

We are in receipt of a very handy little device for determining the size of wires to carry given currents, and which may be called a mechanical wiring calculator. It is designed to be applied to circuits operating at 110 volts and feeding one-half ampère lamps. It consists of a circular card about four inches in diameter, having near its outer periphery three circles of numbers representing the size of wires, each circle of numbers corresponding respectively to 5, 10 and 15 per cent. of loss or drop in the wire. Attached concentrically to the larger card by a pivot is a second, upon whose periphery are spaced a series of numbers representing lamp feet, and running from 1 to 152. To use the card all that is necessary is to multiply the number of lamps by the distance in feet, so as to obtain the lamp-feet. This being known, the number given is selected on the inner card, and that number brought opposite an arrow printed on the larger card. A second arrow on the smaller card will then point directly to the number of the wire required. The use of the card is so simple that it can be put into the hands of the greatest novice, while it offers a ready means for those even who are able to calculate from tables the wire required.

The little calculator, which can be conveniently carried in the pocket, was devised by Mr. A. B. Smith, and is published by the E. S. Greeley & Company, of this city.

Mayor Grant on Overhead Wires.

In his annual message to the aldermen of New York City, Mayor Grant says:

For many years our thoroughfares have been obstructed and disfigured by unsightly poles and dangerous electrical wires. Laws have been enacted providing for the burial of electrical conductors, but until recently no apparent effort had been made to enforce them. In the early part of the present year energetic and decisive measures were taken to abate this nuisance. From some of the leading thoroughfares these obstructions have been entirely removed, and it is the firm purpose of the local authorities to prosecute this reform to a speedy completion. By the close of next summer it is confidently believed that every pole will be removed from the streets, and that every electrical wire will be operated underground in properly-constructed subways.

Since the 1st of January, 1889, the Bureau of Incumbrances has removed 2,495 poles and about 14,500,000 lineal feet of electrical wires.

The public authorities have recently felt compelled to remove from the streets wires which were believed to be dangerous to human life. By this action some portions of the city were deprived of the use of electric lights. The interruption of this service will, however, be but a temporary one. Already subways have been constructed in some of the leading thoroughfares, and it is hoped that sufficient will be constructed during the coming year to accommodate the entire electrical industry in the city.

By the provisions of law now in force the official existence of the Board of Electrical Control will terminate during this year, and its powers and duties will become vested in the Commissioners of the Sinking Fund. The duties of any board, charged with the supervision of electrical conductors, must necessarily be onerous and difficult. They should be discharged by officers who possess some knowledge of electrical science. A board of electrical control, composed at least to some extent of electrical experts, would be a great assistance to the local authorities in dealing with those branches of industry which are compelled to maintain electrical wires in the streets.

The Rhode Island State Electric Lighting Association.

A meeting of central station companies, doing business in the State of Rhode Island, was held Thursday, Jan. 7, for the purpose of organizing a State Association.

A majority of the companies, and about 75 per cent. of the capitalization in the State, was represented. Letters were read from officers of companies who could not attend, expressing their approval of the movement and pledging their co-operation. The organization was effected by the election of the following officers: President, Samuel P. Colt, Bristol Electric Light Company; Secretary, Samuel G. Stiness, Pawtucket Gas and Electric Light Company; Treasurer, Marsden J. Perry, Narragansett Electric Lighting Company. The officers of the association constitute its executive committee.

The New Hampshire Electric Light Association.

The central station companies of New Hampshire held a meeting to organize a State Association, Thursday, Jan. 9. The response to the call for the meeting was almost unanimous. Nearly every company in the State was represented either in person or by letter. A careful estimate showed that over 80 per cent. of the capital employed in central station lighting in the State was represented in person.

The desirability of organizing a State Association was fully discussed, and the proposal to organize at once was cordially endorsed.

The organization was effected by the adoption of by-laws and the election of the following officers:

President, Alonzo Elliott, Manchester; *Vice-President*, F. W. Eastabrook, Nashua; *Secretary and Treasurer*, Edgar Woodman, Concord. *Executive Committee*—Alonzo Elliott, Manchester; F. W. Eastabrook, Nashua; H. W. Burgett, Dover.

A resolution was adopted directing the secretary to send an invitation, with a blank application for membership, to every central station company in the State.

The meeting was held in one of the handsomely furnished parlors of the Manchester House, which has been open but a few weeks. It is said to be the finest hotel in New England outside of Boston and Providence. It is charming and comfortable, and out of consideration for its large patronage from New York City people, it has been made *perfectly* safe; it is lighted throughout by gas.

After the adjournment of the meeting, President Elliott's invitation to partake of a dinner, laid in the handsomely equipped hotel dining room, was gladly accepted. The experiences of the day justify the statement that New Hampshire can be depended upon for things that are useful and good.

Mr. A. R. Foote, Chairman of the National Committee on State and Municipal Legislation of the National Electric Light Association, calls attention to the fact that this is the fifth State Association.

American Institute of Electrical Engineers.

We are in receipt of the following from Secretary R. W. Pope of the Institute:

The following named gentlemen have been elected to Associate membership in the American Institute of Electrical Engineers since the publication of the revised catalogue, Nov. 1, 1889:

At Council meeting, Nov. 12, 1888.—Wm. C. Benbow, electrical expert, Thomson-Houston Electric Company, Boston, Mass.

Geo. P. Wardell, United States Electric Lighting Company, 19 Cedar street, Newark, N. J.

I. E. Winslow, railway expert, Thomson-Houston Electric Company, New York.

Sidney Z. Mitchell, electrical expert, N. W. Electrical Supply & Construction Company, Seattle, Washington.

F. H. Smith, civil engineer, 227 E. German street, Baltimore, Md.

Franz Schulze Berge, assistant, Edison Laboratory, Orange, N. J.

Frankland Jannus, solicitor of patents, 928 F street, Washington, D. C.

Hammond V. Hayes, electrician, American Bell Telephone Company, Boston, Mass.

Francis G. Daniell, railway expert, Thomson-Houston Electric Company, 403 Sibley street, St. Paul, Minn.

H. F. Parsell, Jr., student, Stevens' institute, 31 East Twenty-first street, New York.

Henry G. Fiske, electrician, Croton Magnetic Iron Mines, Brewster's, N. Y.

Charles W. W. Spicer, Edison Phonograph Works, Orange, N. J.

Charles Gorton, electrical engineer, Clark Bros., Belmont, N. Y.

John J. Moore, Thomson-Houston Electric Co., 425 East Twenty-fourth street, New York.

Dec. 3, 1889.—Huntington Lee, Representative, F. H. Whipple, 18 Cortlandt street, New York City.

Captain S. W. Roessler, Corps of Engineers, U. S. A., Willet's Point, Whitestone, N. Y.

E. V. Bailliard, Electrical Inspector, Electrical Accumulator Company, 44 Broadway, New York.

Chas J. Bogue, Electrical Expert, New American Arc Light Company, 256 W. 40th street, New York City.

Jan. 7, 1890.—Alfred A. Dion, electrican, Intercolonial Railway, Moncton, N. B.

John E. Davies, professor of Physics, University of Wisconsin, Madison, Wis.

Gilbert Wilkes, U. S. N. assistant to inspector of electric lighting, Navy Department, Washington, D. C.

Justus B. Entz, electrical engineer, 1065 Madison avenue, New York.

Geo. W. Moss, station manager, C. & S. A. Co., Tehuantepec, Mexico.

H. Doijer, assistant in physics, Polytechnical School, Delft, Holland.

Wm. J. Hancock, superintendent of telephones, Department of Public Works, Perth, Western Australia.

Harris Henry Eley, Western Counties & South Wales Telephone Company, Bristol, England.

Will F. White, secretary and treasurer, Western Engineering Company, Kearney, Neb.

Donald M. Bliss, electrician, Canada Electric Company, Amherst, N. S.

Alexander S. Brown, general manager, Morristown Electric Light, Heat and Power Company, Morristown, N. J.

The following associate members have been transferred to full membership, upon approval of the Board of Examiners:

Dr. Chas. B. Dudley, Altoona, Pa.
J. T. Marshall, Harrison, N. J.
Leigh Carroll, Birmingham, Ala.

Obituary—Amzi S. Dodd.

Amzi S. Dodd, one of the pioneers of the baggage express business in this city, and well known from his connection with various electrical enterprises, died on Jan. 10 at the home of his son-in-law, Joseph Kavanaugh, in this city. Mr. Dodd leaves a widow, and a son and a daughter, both of whom are married. Mr. Dodd was born in Rochester, N. Y., nearly 58 years ago, and received a common school education. When 20 years old he came to this city and obtained a situation as assistant cashier in the Marine Bank. Becoming imbued with the idea that money was to be made in a parcel and baggage express business, in 1859 he started the New Jersey express in Newark and this city. The business grew rapidly, and in a short time Mr. Westcott joined Mr. Dodd in the business in this city. They continued together for several years. A division of the business was then effected, by which Dodd's Express took the baggage express business of the New York, New Haven & Hartford Railroad, the Pennsylvania system, the Central Railroad of New Jersey, and the river and Sound boats. In 1872 another change was made, when the business was sold to the New York Transfer Company, of which Mr. Dodd became a director and secretary. From the original plant of two horses and wagons, the company now has use for 550 horses, 400 vehicles, and employs 400 men. During the past thirty years—except for an interim of eight years—Dodd's Express and the Transfer Company have handled the United States mails in this city.

Mr. Dodd was one of the first men to become interested in telephones, and was largely instrumental in the organization of the Metropolitan Telephone Company. Associated with him in the organization were Theodore N. Vail, ex-Postmaster Henry G. Pearson, William A. Woolverton, Mr. Holmes and F. T. R. Brady. Mr. Dodd was its treasurer.

Mr. Dodd was also interested in the Consolidated Telegraph and Electrical Subway Company and other telegraph and telephone organizations. He was also a member of the Society for the Prevention of Cruelty to Animals, St. John's Guild, the Lotos Club, and St. John's Lodge of Masons, of Newark. He was a man of quick and generous temperament, and very popular.

The funeral services took place on Sunday, Jan. 12, at the Little Church Around the Corner, and were largely attended by prominent electrical capitalists and engineers. The interment took place on Monday at Long Branch.

The Kortheuer Electric Launch "Edison."

Two bright young boys named Frank and Arthur Kortheuer, living on the west side, recently made with their own hands a neat little electric launch which they christened the "Edison," after the great inventor, and with which they have had great success on the yachting lake in Central Park. One of the brothers wrote the following letter recently to Mr. Edison:

"I have constructed a boat propelled by electricity, and I have taken the liberty to name it after you. The 'Edison' is two feet long, of five inches beam and five inches deep. It is run by a small Greeley motor, connected directly with the shaft which turns the propeller. The cells are of a cylindrical form, $2\frac{1}{2} \times 4\frac{1}{2}$ inches each (carbon and zinc), and I use bichromate of potash, sulphuric acid and water for fluid.

"The hull is of wood, and my brother and I hollowed it out; it took a long while, because we had no experience in making boats. Its speed is about two or three miles an hour. I am 16 years of age and my brother is 13. I am very much interested in electricity, and I have two miniature electric lights and an induction coil.

"I write this letter, thinking that you would be interested in my boat, which is the first miniature electric boat that I have heard of made by a boy. If it is not asking too much, I would ask you to tell me if there is any other battery which is more powerful and would make the screw turn more rapidly, and which is of the same size? I inclose a diagram of the boat, which I have drawn."

To this Mr. Edison sent the following gracious reply by his private secretary, Mr. A. O. Tate, and the two boys prize the letter as one of the most valuable of their possessions.

"*Dear Master Kortheuer:*

"Your letter of 3d instant, addressed to Mr. Edison, was duly received.

"Your boat appears to be well designed and looks a very creditable piece of work. There are more powerful batteries than the one you are using, but they are not usually made small enough for your boat. You can, however, make them yourself, if you wish to give as much time to the work as you already must have given to the other parts of the design. You will probably have to take out the two cells you have got in order to give the necessary space. You can then put in five or six smaller glass cells; or if you have any difficulty in procuring them of the right size, you can insert wooden partitions, crosswise, like miniature bulkheads, about an inch apart. You should be very particular to get them all water tight, which you can effect by soaking them with asphalt varnish or marine glue. You will then have five or six cells in the boat itself. Then take a sheet of thin zinc and cut it up with shears into strips wide enough to fit in crosswise, one to each partition. Next get some carbon flat plates, whatever size you can, that will fit one to each partition, and fill in finally with a solution of basic sulphate of mercury in water—about four ounces should be sufficient of salt for the six compartments. You will then have six complete cells. No porous cell or partition will be necessary, and the zincs will amalgamate themselves."

The "Edison" launch is the champion of Central Park, and challenges all comers of equal size.

Traveling Arrangements for the Kansas City Convention.

Mr. Allan V. Garratt, secretary of the National Electric Light Association, has issued two circulars with regard to the traveling arrangements for the Kansas City Convention. One is the following from Messrs. C. E. Stump and G. F. Porter, of the transportation committee, as follows:

For the benefit of delegates and others attending the eleventh convention of the National Electric Light Association, to be held at Kansas City, Feb. 11-14, arrangements have been made with the Pennsylvania Railroad to provide a magnificent vestibule train to be known as the "Electric Limited," to be run through without change to Kansas City via Chicago and the Chicago, Burlington & Quincy Railroad.

This train will leave Jersey City Sunday, Feb. 9, at 9:45 A. M. sharp, arriving at Chicago Monday morning at 9 A. M.

Monday will be spent in Chicago, the Chicago Electric Club having kindly invited the Eastern delegates to enjoy its hospitality during their stay in that city.

The "Electric Limited" will leave Chicago Monday evening at 5 o'clock, arriving at Kansas City early Tuesday morning.

Passengers should be careful to take the ferry at foot of Cortlandt or Desbrosses streets, New York, not later than 9.30 A. M. Sunday morning.

No effort has been spared by the transportation committee in obtaining the very best equipment, and the committee is assured that this train will be the finest ever run out of New York. It will be composed of the latest Pullman vestibule sleeping cars, lighted by electricity, a dining car, composite car containing barber shop, bath room, card room, library, writing desk, smoking room, etc., and an observation car with a large open room luxuriously furnished, as well as an observation platform.

The train will be supplied throughout with fixed and portable electric lamps.

Special accommodations will be provided for members accompanied by their wives.

The rate of fare going, including sleeping car accommodations, will be $39.75, and inasmuch as it is necessary to guarantee a certain number of people in order to secure this superb train, it is important that those who propose attending the convention fill up the enclosed blank and return same, together with remittance, as promptly as possible, to C. E. Stump, Chairman Transportation Committee, *Times* Building, New York, upon receipt of which, railroad and sleeping car tickets will be at once forwarded.

Extensive preparations have been made to render this one of the most interesting conventions ever held, and it is expected that members will do their utmost to induce as large an attendance as possible.

In his other circular Mr. Garratt announces that he is in receipt of a cordial invitation from Mr. W. A. Kreidler, secretary of the Chicago Electric Club, asking the members en route to Kansas City to accept its hospitality on Jan. 10, and that he has accepted the invitation in the name of the Association.

He also requests that delegates from New England will communicate with Mr. F. A. Gilbert, of Boston, chairman of transportation for New England.

Another Board of Electrical Control Meeting.

It cannot be said that the last meeting of the Board of Electrical Control, held on the 4th inst., has done anything to reassure the public mind as to the efficiency and practical value of the board. The evidences of internal dissension were scarcely less prominent than they were at the previous meeting of some months ago, and this want of unanimity among the commissioners augurs very unfavorably for the work of the board for the remaining portion of its term, which expires in November next.

The report of the faithful electrical expert, Dr. Wheeler, gives the mileage of wire operated by the companies using electrical conductors underground. The Metropolitan Telephone and Telegraph Company has 10,906; the Western Union Telegraph Company, 578; the Postal Telegraph Company, 35; the United States Illuminating Company, 88; the Brush Electric Illuminating Company, 38; the Manhattan Electric Light Company, 67; the Harlem Lighting Company, 10; the Mount Morris Electric Light Company, 2; the Edison Electric Illuminating Company, 252; the New York City Fire Telegraph, 332; giving a total mileage of 12,308. The report states that the results of the use of the underground conductors are very satisfactory. The tests of the conductors used for high tension currents show that there is no deterioration at present perceptible in the cables, although some of them have been in use for six months. Wherever imperfections in the underground circuits have been discovered by the tests furnished by the companies, they have resulted from bad workmanship in making joints and connections, or the exposure of the ends of the cable to the weather. It is stated that the Edison Company, the Brush Company, and the Western Union Company have been negligent in the matter of furnishing tests of underground conductors, and, in order to obviate serious trouble in the future in this respect, it is recommended that the subway rules be so modified as to enable the Construction Company to compel the prompt and proper action of the companies, and the necessity of close supervision of the electric light circuits, and of full power to deal with them if accidents are to be insured against, is insisted on. The condition of the wires is described as being still very unsatisfactory, and although the recent action of the Commissioner of Public Works, under the ruling of the General Term, has disposed of much of the dangerous electric light construction of the city, an immense amount of unnecessary and improper electrical construction still exists. Some of this consists in lines of electric light conductors which have been "cut dead," and which should either be fixed up in accordance with the rules and regulations of the board, and connected with the stations, or be removed as useless and unnecessary obstructions. The removal of the entire lines of the Western Union running north and

south now carried on poles is strongly advocated, as it is shown that in view of the special permits with which that company is provided by the board it is able, besides having accommodation in subways in certain cross-town streets, to utilize north and south, throughout the entire city, both sides of the elevated railroad structures, and east and west pole lines, which have been allowed by the board to be connected to the cables on the Elevated; and the extra lines mentioned are therefore palpably unnecessary. It is urged that the removal of these lines would relieve the streets of the city of an immense number of poles and an immense mileage of wire, and greatly increase the safety of life and property, as well as permit the free use of the streets for other purposes.

It is also pointed out that the telephone company, which has great facilities already in the subways, can dispense with many of its duplicate lines on the same streets, and lines in streets which are adjacent to other streets, and the early action of the board in the matter is recommended.

"The work of the Board of Electrical Control in relieving the streets of poles and wires would be greatly facilitated if more active co-operation on the part of the Fire and Police Departments could be had. It is impossible to remove lines which have been abandoned by the telephone and telegraph companies when the wires of the Fire and Police Departments remain; and although in many instances, at the request of the board, these wires have been removed, still many unnecessary lines exist which could be removed were the Fire and Police Department wires otherwise provided for."

The total number of poles removed is 4,772, the companies having removed 1,765 and the Department of Public Works 3,007. Out of a total of 5,615 miles of wire, 2,788 have been removed by the companies and 2,827 miles by the Department of Public Works. In alluding to the violations of the rules of the board, the expert speaks of the deaths caused by electricity and says: "In my judgment these would all have been prevented by observance of the rules and regulations of the board."

The report of the engineer of the board (Mr. Kearney) was read. A list of the streets in which subways had been laid was given, and the general condition of the subways was stated to be satisfactory in the main. "The subways are comparatively free from moisture and gases. The question of ventilation is receiving attention. In all of this year's construction a 6-inch pipe, for the purpose of ventilation, has been put into each manhole, forming a continuous and open channel for the forcing in of fresh air and the forcing out of gases and vapors."

The immediate construction of subways in certain streets was recommended, and the engineer stated that such work would take two years; it could be done in one year if enough men were put upon it.

The engineer was directed to confer with the Commissioner of Public Works as to the work to be done.

When the annual report of the board to the Governor and the members of the Legislature was brought on, the Mayor wanted it to be laid over, but Commissioner Gibbens wished it read. Before its reading had proceeded far, the Mayor said: "I cannot vote for that report, because it cites certain things that are not within my knowledge, and because of certain other matter it contains, about which I would rather not have anything to say." The report, however, was put to the meeting and adopted.

The meeting was adjourned subject to the call of the chair.

The Westinghouse Electric Lighting Industries.

The year which has just closed has been the most progressive one in the history of the Westinghouse Electric Company. The business done during 1889 surpassed anything ever anticipated.

The company reports that it has now 266 central stations distributed throughout the country and abroad, which are fitted up with Westinghouse alternating current apparatus. The contracts for 134 central stations were secured during last year, making the business of that period exceed the combined amount of the previous years since the organization of the company in 1886. These 134 central stations represent an aggregate capacity of 234,250 incandescent lamps. This does not include the various increases, which were also contracted for by various companies already established.

In studying the enormous growth of the concern, the following comparative facts may be interesting: In January, 1889, the company employed 650 men in their works on Garrison alley, Pittsburgh, Pa. During this year, however, many improvements were necessitated, and to-day the company employs 1,300 men in Pittsburgh alone A new building of five stories was built during the year for the detail department, a pottery and a laboratory. In the detail department the alternating current meters are made. The production of that article has increased 400 per cent. during the year. In the pottery—which, by the way, is a complete factory—switches, cut-outs and other devices are made. The laboratory has been fitted up with all those requisites which make a place of that kind perfect, and the Westinghouse laboratory is now considered by those who have visited it the finest and most complete in the country.

The machine shop has been repeatedly enlarged to meet the demand made upon it by the increased number of contracts. Several new engines were put into the building, and a new battery of boilers, consisting of two Babcock & Wilson boilers of 500 h. p. each.

The lamp factory of the company was removed during the year to New York, to give more room to the converter department.

In March, 1889, the company started in the arc lighting business by absorbing the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. This gave a fresh impetus to that business, and the number of Waterhouse machines sold since then has been large.

During the year the company also established a branch in London, England, for the purpose of taking care of the European business, and the accounts received from there are very promising.

Dinner of the Boston Electric Club.

The House and Entertainment Committee of the Club for the year 1890 held their first meeting on Thursday evening, Jan. 9, and will report at the next meeting of the Club a full programme of papers and dinners for the first half year. There will probably be one paper each month until May, and a monthly dinner at which a discussion will be held on some subject to be announced. The new committee consists of A. L. Rohrer, chairman; Alex. P. Wright, secretary, and W. A. Stiles. The fourth annual banquet was held on Jan. 6 at Young's Hotel.

The banquet was in the nature of an inauguration dinner to the following newly-elected officers: President, A. B. Cram; First Vice-President, A. L. Rohrer; Second Vice-President, George B. Neal; Third Vice President, George W. Adams; Fourth Vice-President, C. W. Holtzer; Treasurer, F. J. Boynton; Secretary, R. F. Ross; Historian, George W. Mansfield.

Around the table were gathered the following members and guests:

A. B. Cram, Alexander P. Wright, R. F. Ross, Charles W. Holtzer, A. L. Rohrer, B. S. Lovell, F. J. Boynton, H. C. Spaulding, O. S. Hussy, W. B. Pettingell, Arthur B. Griggs, Count Roman T. Zuboff, C. F. Willard, H. W. Austin, W. J. Denver, F. A. Houston, C. M. Ransom, James F. Meech, W. A. Stiles, Arthur Lord, George W. Mansfield, S. E. Barton, Charles S. Burleigh, H. J. Pettingell, Frank Ridlon, J. R. Lovejoy, James R. Magee, A. F. Mason, T. W. Coakley, W. S. Key, D. S. Robeson, T. McCoubray, Dr. E. B. Kellogg, F. G. Williams, George B. Neal, C. F. Prichard, Herbert C. Wert, Albert C. Burrage, Dr. G. L. Austin, F. C. Pettingell, C. H. Billings, J. H. Mason, F. A. Buttrick, L. J. Ford, G. H. Almen, C. E. Tingley, W. E. Stow, S. B. Stiness, A. C. Shaw, John C. Wilson, Dr. A. de Bausset, W. D. Warner, C. B. Price, G. W. Adams.

When the cigars began to send up their fragrant whirls of smoke President Cram announced the new officers for the coming year and called on the secretary, who read letters of regret from Governor Brackett, Mayor Hart, C. A. Coffin, president of the Thomson-Houston Company, and a telegram of regret from William Brophy.

Speeches were made by President Cram, and Messrs. W. J. Denver, F. Ridlon, W. A. Stiles, A. Lord, C. M. Ransom, Count Zuboff, J. F. Meech, G. W. Mansfield and Dr. A. F. Mason. The dinner was a great success.

New Electric Light Station at Dedham, Mass.

The new electric light station at Dedham, Mass., is rapidly approaching completion and will be started up within the next few days. The system used is that of the Thomson Houston Company, who have done all the outside construction work, but the entire station, including building, boilers and engines, has been erected by the Jarvis Engineering Company, of Boston. The building, which is of brick, is 80 feet long by 48 feet wide, and is one story high, with a brick chimney 100 feet high. In the boiler room are two boilers of 100 h. p. each, made by E. Hodge & Co., of Boston, with Jarvis patent setting and Sheffield grate bars for burning cheap fuel, a Deane feed pump, Korting injector, National feed water heater, and Deane condenser and pump. There are two engines of 100 h. p. each, of the Armington & Sims compound condensing type, and there is an abundance of spring water in the vicinity for condensation purposes. The pump, condenser, and heater, are sufficient for 300 h. p., to allow of increase of plant, and there is space in the boiler room for one more 100 h. p. boiler. The condenser is a jet condenser, the cold water coming in actual contact with the steam; and the valves are so arranged that the engines can be made non-condensing, and exhaust through the heater direct into the atmosphere if desired. Two 30-light arc dynamos, and two 650-light alternating incandescent dynamos will be installed at present, and the foundations for the dynamos are somewhat novel in construction. Instead of the ordinary six-foot foundation under each dynamo, a series of brick piers have been built on which rest heavy timbers all the way across the dynamo room. To this has been secured the flooring, and the dynamos will be bolted down directly to the floor. In the centre of the building is the wire tower, and all wires are brought into the building through conduits manufactured by the Interior Electrical Conduit Company of New York. The station is conveniently situated close to the Old Colony Railroad, and coal can be dumped direct from the tracks into a coal chute adjoining the boiler room. The arrangements of the station are very elaborate, and when complete this will be one of the best appointed of the small stations in the country. Much credit is due the Jarvis Engineering Company for its excellent construction and well designed plans, and Dedham has every reason to be proud of having a station which can be operated on the most economical and scientific principles.

A. C. S.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Jan. 11, 1890.

The Daft Storage Car, now being run in Philadelphia, is equipped with the batteries of the Gibson Electric Company, who are making a strong bid for this class of work, and whose batteries are highly spoken of for street cars.

Dr. Joseph De Lery, who developed the business of the Wenstrom dynamo in this country, and has introduced a large number of the machines for light and power, particularly in the South, has been elected general manager of the Wenstrom Southern Electric Manufacturing Company.

The McAllister Ball in the big Metropolitan Opera House was notable for the success of its decorations. These included incandescent lighting, and I understand that the local Edison Company made a fine display of energy and ability in putting up hundreds of special lamps for the occasion.

McElroy & Emmet, 36 Cortlandt street, printers to the American Institute of Electrical Engineers, have issued a quaintly artistic calendar. It is said that the design was made by the junior member of the firm, as was that issued by them last year. Mr. Emmet is an old electrical man, and well known to many in the profession.

A Bad Subway Explosion occurred about 8 P. M. on January 11, at the corner of Sixth avenue and Fourteenth street. Nobody was hurt, but the street was ripped up for some distance, and two manholes were "busted." The scene was visited on Sunday by a large number of curious spectators. Subway explosions are now reckoned among the regular sights in town.

The Holland Society held its dinner on January 10 in the grand hall of the Equitable Building. There were a number of special lighting effects carried out with the help of the United States plant in the basement, of which Mr. W. Wheeler is the efficient electrician. The decorations included twenty large pine trees, fitted each with about a dozen incandescent lamps, shaded in pink silk. Over the magnificent glass dome of the hall were set 180 lamps of 100 c. p.

"The Electrical World" Offices.—In connection with the recent article on the above subject, it may be mentioned that the special glassware on the electric fixtures came from the Phœnix Glass Company, of 728 Broadway, who are the greatest producers in this line in the world. The beauty of the glass is much admired by all who see it. It may further be noted that the special annunciator put in was made by Hazazar & Stanley, of Frankfort street, whose wiring on the job was one of the neatest pieces of work possible.

C. McIntire & Co., Newark, N. J., have moved to the building Nos. 13 and 15 Franklin street, and will be pleased to fill promptly all orders they may be favored with, as they will have a full line of McIntire's patent connectors, terminals, tools and other of McIntire's patented specialties constantly in stock. They have placed a long distance telephone in their office for the convenience of customers wishing to order by telephone. They have orders for 100,000 connectors and terminals in hand, but, with larger quarters, will soon rush them through.

The Aluminum Brass and Bronze Company, of the Stewart Building, 53 Chambers street, are now comfortably installed in these new quarters, where Mr. T. C. Fowler, the general manager, will be found ready to explain the merits of the useful metal he represents. While in his office the other day, I picked up a bar of the metal that looked like weighing about 10 pounds. I bent my muscles to the task, but it came up so lightly I nearly fell over backward. Electricians are generally familiar with the splendid qualities of aluminum, and there is no question as to the demand for the metal in electrical trades.

The Empire China Works, Greenpoint, Brooklyn, are manufacturing a porcelain ware that is scientifically vitrified so as to resist currents of the highest tension as well as all the influences that tend to break down insulation. This ware will stand any kind of weather and sea air, as well as that of cities and factories where chemicals are freely used or gases are generated. It does not crack or become brittle, and will stand any test except that perhaps of the cowboy marksman. It is being found to be particularly applicable to ceiling cut-outs, fuse boxes, switch bases and numerous other light and power appliances, as well as for interior and exterior wiring.

A. A. McCreary, 18 Cortlandt street, the reflector shade manufacturer, is meeting with a wonderful demand for his incandescent bulb revolvable shade and reflector. These goods are made in glass of any desired color, to throw out a mellow light for many uses. He showed me last week a new bulb shade of several pretty colors, and of corrugated glass, giving a beautiful effect. He has them also in mottled and ground glass, which will be the coming fad for dinners, balls, society affairs, etc. His standard reflector shades are constantly increasing in demand. He is making also a patented mica cover for arc lamp globes to keep out the dust, dirt, sleet, snow, etc., and is bringing out other useful articles needed in the industry.

W. H. Gordon & Co., 115 Broadway, dealers in electric light and power supplies, report a good demand for their specialties, and have lately increased their line, which has necessitated additional storage room. They are fully stocked with all the latest devices in electric light and power appliances, and are prepared to fill orders with unusual promptness. Among a few of their added specialties are Fletcher's sleet proof pulleys for suspending arc lamps; also Fletcher's arc lamp windlass, high insulation brackets for walls, roofs, cornices, etc.; and new incandescent snap switches of improved and very simple mechanism. Their oil filters are meeting with excellent sales. They have a large trade in fuse wire, of which they have just issued a new price list.

Mr. F. R. Chinnock, 56 Garfield Building, Brooklyn, Edison agent, reports having recently closed the following contracts: Flushing & College Point Railroad Company, plant of two large dynamos to operate six Stephenson cars, which will be equipped with motors, to run between the two places named. They have also contracted for two 600-dynamos for lighting in Flushing. Mr. Chinnock has also sold a 600-light plant to the Delaware, Lackawanna & Western Railroad Company, as an increase on their present plant at Hoboken; a 75-light plant to S. K. Wilson, match factory, Trenton, N. J.; a 1,000-light plant to the Botta y Worsted Mills, Passaic, N. J., one of the largest worsted mills in the State; a 20-arc-light plant to the Spaulding Jennings Steel Works, Bergen, N. J.; a 150-light incandescent plant to the New Jersey Zinc and Lead Company, and a plant of 225 lights at Roselle, N. J.

J. H. Bunnell & Co. have got nicely settled in their handsome new quarters at 74 and 76 Cortlandt street, and their store is well worth a visit. It is just about a dozen years since this progressive firm began business, and this is the fourth time that its steadily increasing trade has rendered more room necessary. On the first of these occasions the demand was satisfied for a time by taking one or two additional floors in the building first occupied by the firm at 112 Liberty steet, and moving the office and salesrooms from the first to the ground floor. Later, larger quarters were leased at 106 and 108 Liberty street, but even these have been outgrown, and now the sign of J. H. Bunnell & Co. is seen on the beautiful new building corner of Cortlandt and Washington streets. Both Mr. Bunnell and his partner, Mr. McLaughlin, say they cannot seriously complain of the condition of the electrical business or of their own success in the past. Mr. McLaughlin adds that the work they turn out is as good as it ever was, and their increasing sales would certainly warrant this assertion.

The Interior Electrical Conduit Company, factory 154-156 West Twenty-seventh street, this city, whose system is so well spoken of, and is being so generally adopted throughout the country, is officered by old electricmen. The president, Ed. H. Johnson, is the former president of the Edison Electric Light Company, and he will hereafter give more attention to the development of the conduit business. E. T. Greenfield, the general superintendent, is one of the oldest wiremen in the country, and has invented many of the safety appliances now in use. W. A. Willard, the secretary and treasurer, was formerly assistant to the general manager of the Edison Manufacturing Company, at 65 Fifth avenue, New York. The company reports great progress, having disposed of over 1,000,000 feet of tube and accessories during the past six months. It receives large new orders daily, and is sending many thousand feet as far west as the Pacific. At present it finds its quarters rather taxed to meet the demands made on it; but arrangements are now being carried through to enlarge the factory. Never did a new industry deserve better of the electrical community than this.

The Bishop Gutta-Percha Company.—Mr. Henry A. Reed, the veteran manager of this company, in discussing the situation with me this week, remarked that the wire they use is electrically welded, and is furnished thus to customers in any desired length. Hence greater resistance to strain is insured. Their special rubber compound is applied by a force so great as not only to make the mass of insulation, however thick, perfectly homogeneous but firmly adhesive to the wire, so that it cannot possibly be removed without being scraped or burnt off. This makes it impossible for moisture to enter between the wire and its covering. In respect to joints or seams in the insulation, Mr. Reed says that the Bishop Company has now covered wires without seams in the insulation for over forty years, and that it applies the insulating material by hydraulic pressure, which compresses the molecules of the dielectric together with much greater force and resultant intimacy than can possibly be obtained by any of the so-called "pipe machines"; giving, in fact, more than double the insulation obtainable with such machines. The Bishop Company are preparing thousands of feet of electric light conductors for the New York conduits, of No. 4 B. & S. pure copper, with one-eighth inch rubber compound insulation. In the big plant recently installed by the Brush Company, of Cleveland, in the Washington Navy Yard, the company placed 30,000 feet of No. 6 B. & S., insulated with their special rubber compound, according to the rigid specifications of Lieut.-Commander Bradford. The Bishop Company are now insulating wire for the entire electrical equipment of the cruiser "Vermont." They have just delivered two gutta-percha cables to the Life Saving Department for the coast telegraphic and telephonic service, and have more under construction. Another somewhat novel contract is that they have in hand for furnishing a 70-conductor cable, as made before, for the Roosevelt Organ Works, to use on their electric organs for the Chicago auditorium.

Graphite Bushings.—The Graphite Lubricating Company, of Jersey City, N. J., say that the use of graphite bushings and bearings on electrical machinery is a new field for them, and sufficient time has not elapsed to allow them to say much on the subject. The company place their bushings on the market under two claims as to their use. One is that they will run without oil, when substituted for bearings running satisfactorily with oil. The other is that they will, when a bearing surface is reached, run with diminished quantity of oil and without cutting, when substituted for bearings which heat and cut with oil. Messrs. Billings & Spencer, of Hartford, Conn., were using graphite bushings on the Frisbie clutch pulley with satisfaction, and desired Mr. Frisbie to fit their Waterhouse dynamo with graphite bushings. The oiled bearings were giving them trouble. This was done, and while with oiled bearings one cup of oil was used in a day, the oil was at once diminished to one cup a week, and at last report to one cup a month; the dynamo is of 300-light capacity. The D. Frisbie Company lately furnished to the Pleasant Valley Electric Railroad Company, of Pittsburgh, Pa., three friction clutch pulleys, 5 feet in diameter, 38 inches face, to go on 7-inch shaft. These were each fitted with two graphite bushings, each 14 inches long, leaving 10 inches in the centre of the hub not bushed. These pulleys each carry a 38-inch double leather belt, put on tight with clamps, and the shaft makes 300 revolutions a minute. The pulleys have been running now for one month to the satisfaction of the railroad company. The pulleys were started with a little oil, and oil has continued to be used up to this time. The D. Frisbie Company are also using the graphite bushing on their elevators, in connection with electric motors, and they do not put an elevator up unless the loose pulleys are fitted with graphite bushings and washers. One electric motor company manufacturing small motors commenced to use the bushings in July last, and a month or two ago wrote to the Graphite Lubricating Company, saying that they expected to use the bushings on all their motors. The company, at this writing, are filling the third or fourth order from this motor company. Since July 1 the Graphite Company have received orders from 14 different houses for bushings for trolleys, motors, dynamos, etc.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Jan. 11, 1890.

Mr. George T. Manson, of Okonite fame, was in Boston this week looking up his numerous friends, who tried to entertain him in true Boston style on the evening of his arrival.

Mr. George Gartland, one of the staff of the Brush Electric Company, passed through Boston this week on his way to Bristol, where he will superintend the construction of the outside work on the new Brush plant recently sold to the Bristol Electric Light Company.

Boston Electric Club.—The fourth annual dinner of the Boston Electric Club was held at Young's Hotel, on Monday evening, the 6th inst., when President Henry B. Cram was formally installed in place of President Denver, retiring. A very pleasant evening was spent, and some excellent speeches were made by members and their guests.

The Holtzer-Cabot Electric Company, 111 Arch street, Boston, have issued a very fine calendar. The top part is occupied by a superb Lowell engraving of a couple of tigers in their cage—a remarkably fine and faithful piece of work. The date pad is neat and ornamental. On the card are one or two modest references to the business of the concern.

Frank Ridlon & Co.—During the past year Mr. Frank Ridlon, than whom there is no man better or more favorably known among the electrical fraternity, started the firm of Frank Ridlon & Co., which is now doing a large and successful business in buying and selling second-hand apparatus. They hope to present themselves still more to the notice of the trade in the coming year.

Mr. W. M. Rand, for many years connected with Mr. Frank Ridlon as a salesman of motors, has accepted the position of chief salesman of the Thomson-Houston Motor Company, whose headquarters are at 620 Atlantic avenue, Boston. Mr. Rand's record is a good one, and good success continues to attend him in his new field. Manager Spaulding has secured a valuable acquisition to his staff.

Paine & Francis, the local agents of the Edison system, have passed through a very successful year. They have paid special attention to isolated lighting, and have installed plants in a large number of the finest mills and factories, and important office buildings. They have made a specialty of using water power for factory plants, and with the Edison automatic regulator have had remarkable success in installing efficient plants.

Lynn, Mass.—The Lynn Gas and Electric Company have just started up a new 500 h. p. Corliss compound condensing engine, which will furnish power for all the dynamos at present, except the generators for the motor work. The countershaft is fitted with Hunter friction gear. A Wheeler surface condenser is used, which allows of the use of salt water pumped directly from the adjacent bay. Nearly all the repairs made necessary by the recent fire have now been made.

Mr. W. R. Scott, superintendent of electrical construction of the Lindell Railway Company, of St. Louis, is in Boston this week looking up supplies for the extensions of their electric railways in that city. Mr. Scott was formerly located in Boston, and was engaged with Mr. McQuesten, of New York, in the construction work of the West End Street Railway Company. In St. Louis, at present, the Lindell Railway Company are running both horse and electric cars (Sprague system), but it is their intention as soon as practicable to convert all the roads now using horses into electric roads, and Mr. Scott expects to have his hands full this spring.

Union Electric Car Company.—I recently saw a section of the spur wheel gearing taken from one of the cars of the Union Electric Car Company, which has been running for some weeks in Beverly, Mass. The spur wheel of cast iron and the spur pinion of brass have run about 2,500 miles, and it is a curious fact that after all that wear the marks of the machine tool which shaped the teeth are still actually to be seen. Looking at the teeth, it is hard to believe that they had been in service more than an hour. It seemed to me a strong evidence of the advantage of inclosing the gearing of an electric car in a dust-proof case. The electric cars of this company continue to give satisfaction at Beverly, and are running regularly on schedule time.

Boston Street Lighting Contracts.—This week Mayor Hart informed the superintendent of lamps, Mr. George H. Allen, that he had awarded the contract for lighting the streets by electricity to the Suburban Light and Power Company at the following terms per lamp per night: City proper, South Boston, Dorchester, West Roxbury, 39 74-100 cents; Roxbury, 37 99-100. The difference between these prices and what the city has been paying is about $73,000 in favor of the city. The company is to begin furnishing light to Roxbury, Dorchester and West Roxbury in six weeks from the signing of the contract, South Boston in twelve weeks and city proper in sixteen weeks. Contracts have been made with the existing companies to continue furnishing light to the city during the interim.

Marr Construction Company.—Mr. H. C. Hawkes, New England agent of the Marr Construction Company, reports having secured the contract for fitting the new theatre in Worcester, Mass., with 574 incandescent lights, the current for which will be furnished by the Worcester Electric Light Company. The lights will be placed throughout the whole theatre, the proscenium, stage and foot lights being all electric. The switchboard will be of slate. It will be of the latest design, and when completed, the whole will be a representative alternating current theatre plant. There will be eight stage regulators, and it may be mentioned here that these regulators, unlike those on direct current apparatus, do not use up any current when the lamps are burning dim. The alternating current lends itself very readily for effective results, and is for this purpose extremely economical.

H. E. Swift & Co. have now got their new premises in thorough working order, and have at last got a factory which gives them some chance to catch up with their large orders. Since moving in they have had to double their plant twice, and have now got about four times as much machinery, help and floor space. Messrs. Swift & Co. are making large quantities of fuse boxes, spars, socket insulators, chandelier cut-outs, "C." rosettes, and have several large orders for special work, for which their factory is unusually well adapted. It is curious to note that they are in receipt of orders from Chicago for the manufacture of special electric goods, as there does not appear to be any factory in the West adapted for this class of work. Among the many specialties which Messrs. Swift are continually making is the "K. W." cut-out, and they have made of these alone within the past few months about 30,000.

National Telephone Manufacturing Company.—Acoustic or non-electric telephones are probably one of the hardest articles to introduce to an incredulous public, and Mr. Bennett, the genial and enterprising manager of the National Telephone Manufacturing Company, has reason to congratulate himself upon the wonderful success he has had in the sale of the "Champion" and Bennett non-electric telephones. There has been a great deal to contend with, the failures of predecessors in this field and the bad reputation they threw over the non-electric telephone business having to be fought inch by inch. Nevertheless success has attended Mr. Bennett's untiring efforts, and his instruments have now a good local and national reputation. They are being constantly improved, and the apparatus of 1890 will, it is promised, embrace considerable improvements, which will make these instruments more valuable than ever.

Pettingell, Andrews & Co. have just secured the exclusive agency for the United States of the Stanley wire cleat. The insurance companies have recently insisted that there should be a back to all cleats for electric work, to prevent the wire touching the ceiling on which the cleats are attached. This cleat is specially designed for this work and is in one piece, and is so made that the cleats can be put up before the wire is strung. On each end of the cleat there is a slit slightly smaller than the wire to be used. Midway up this slit is a recess for the wire to rest in. All that has then to be done is to force the wire in, the wood easily springing apart, until the wire reaches the recess, where it permanently remains. The business of Pettingell, Andrews & Co. has very nearly been trebled during the past year, and they are now one of the largest electrical supply houses in the East. Though they only very recently took largely increased premises, they have already begun to find themselves cramped, and will soon take another room in the Estes Press Building, and will then occupy the whole front of the first floor of this building. They are at present getting up a complete line of porcelain cut-outs of every kind, which they will soon have in stock.

The Gethins Electrical Manufacturing Company was formed last spring for the purpose of manufacturing and selling the Gethins improved gravity battery. This battery is the invention of Mr. J. L. Gethins, for years connected with the Fire Department of Boston, who was led to the belief that some more reliable battery could be designed than those he was using. The Gethins battery has many advantages, which were described in THE ELECTRICAL WORLD of Dec. 28, 1889, and is rapidly coming to the front as a battery requiring a minimum of attention and performing to the letter all that is claimed for it. For the past few months the battery has not been pushed on the market, the directors of the company thinking it wiser to allow thorough and long time tests to be taken of it under severe work. The results of these tests in various cities in Massachusetts, New York and New Jersey have been so satisfactory that the directors have now determined to push this battery into the electric field. The batteries are largely used in New England cities, Boston alone having over 2,000 in use; but recently shipments have been made to Savannah, Ga., Louisville, Ky., and other Southern and Western cities.

Evans Friction Cone Company.—Among the many plants which the Evans Friction Company have fitted up with their frictional system of driving may be enumerated the following: The municipal plant at the Chestnut Hill Water Pumping Station; Attleboro' Electric Light Company, Attleboro', Mass.; Jamestown Electric Light Company, Jamestown, N. Y.; Pettie Machine Company, Newton Upper Falls, Mass.; Fitchburg Engine Company, Fitchburg, Mass.; Putnam Nail Company, Neponset, Mass.; Franklin Electric Light Company, Franklin, Mass.; Florence Electric Light Company, Florence, Ala.; Hutchinson Electric Light Company, Hutchinson, Kan.; Mather Electric Company, for an isolated plant in Boston; Westinghouse Electric Company, Pittsburgh; Morgan Engineering Company, Alliance, O. The dynamo which ran the search light in the Maritime Exhibition, just closed in Boston, was driven by an Evans friction gear, and, notwithstanding the extreme variations of load when the light was turned on and off, it performed the work without a hitch. This system of driving has only come into general use for electric work within the past six months, and, judging from the excellent success and the number of plants installed, it may be safely said that it is destined to be one of the favorite plans of driving in the near future. With this system there is much saving of floor space, an entire impossibility of the belt flying off during a sudden load, great saving of belting, and an entire absence of slip.

Annual Meeting of the New England Insurance Exchange.—At the annual meeting of the New England Insurance Exchange the following officers were elected: President, F. A. Colley; vice-presidents, A. K. Simpson, G. W. Hinkley, C. G. Smith; executive committee, J. H. Burge, W. D. Fitch, R. J. Yatman, A. A. Clarke, F. A. Wetherbee. Mr. S. E. Barton, chairman of the electric light committee, presented an exhaustive report. On one point he remarked: "The necessity of granting a permit in policies for the use of electric lights was a most natural one in the first stages of the business, and we have relied upon the practice as an important part of our method of keeping track of and controlling, the installation of the lights. But the extent to which electric lighting has progressed is beginning to make the permit question a burden, and that it is felt by many to be an unnecessary burden is demonstrated by the fact that we are not infrequently told of managers and special agents of companies advising their local agents that the attaching of permits is not necessary. I have never given that advice, but I believe in it, and I would advocate the discontinuance of the practice simply because it is becoming too burdensome. It must stop sometime, if electric illumination is to continue in popularity as it has during the past seven years." He further recommended the drawing up of a series of authoritative insurance rules, which would be accepted as final by the underwriters of the country.

The Economic Electric Manufacturing Company, with headquarters for the present at 1 Beacon street, Boston, have been organized to do a manufacturing business in dynamos and incandescent lamps. The lamp will be made under a secret process. The company intends to make a lamp which will be guaranteed of the standard candle power, averaged for a definite number of candles for its life. In other words, a lamp purporting to be 16 c. p. will show during its life that number of candles, at an energy of three watts per candle. The lamps will be made of any of the ordinary voltages in common use, though the officers of the company recommend a 65 to 75 volt system, which in their judgment is the most economical system for commercial lighting in isolated plants. In addition to the above, the company will manufacture all kinds of electrical supplies, and also low-priced motors for small work, having secured the license for use of the patent right for one of the latest improvements in motors now on the market. The company will have, in the course of the next fortnight, one of their dynamos running a full load of lamps in the store of Houghton & Dutton, Tremont street, Boston. The officers of the company are: Dr. Robert Amory, president; Mr. N. V. Titus, treasurer; Messrs. George E. Parker, Fred H. Odiorne, B. F. Dutton, directors, along with the president and treasurer. Prof. W. L. Hooper, of Tufts' College, will act as electrician of the company. The officers of the company are now negotiating for factory property in two towns in this State, within 40 minutes' ride by train from Boston, but are in the meantime getting their dynamos and lamps made in Boston.

Wright Electrical Engineering Company.—There is no company in New England which has more rapidly come to the front than the Wright Electrical Engineering Company, of Boston. A year ago this company consisted of only one man, Mr. A. P. Wright, who came from Springfield with an excellent record as an electric light station manager. Within the short space of one year Mr. Wright has gathered around him a number of gentlemen as officers of the company, who each possess a distinct value, and the office staff and foremen now number twenty-five. No better way of showing the success which has been achieved by the company can be adopted than by giving, as below, a list of the material used by this company in their construction work, and a list of the cities in which their work now stands to-day as evidence of the substantial and scientific manner in which such work has been done. Material used since June, 1889: Line work, 250 miles; line wire, 800 miles; poles, 10,000; pins, 50,000; insulators, 35,000; cross-arms, 15,000; lag screws and washers, 35,000; incandescent lights, 7,500. The following is the list of places in which work has been done by this company: Middlebore, Mass.; Weymouth, Mass.; Hingham, Mass.; Haverhill, Mass.; Newburyport, Mass.; Somerville, Mass.; Cambridge, Mass.; Brookline, Mass.; Abington, Mass.; Boston, Mass.; West End Railroad, Boston, Mass.; Nantucket, Mass; Canton, Mass.; Clinton, Mass.; Salem, Mass.; Franklin, Mass.; Woburn, Mass.; Winchester Mass.; Stoneham, Mass.; Narragansett Pier, R. I.; Norwich, Conn.; Danielsonville, Conn.; Rockville, Conn.; Birmingham, Conn.; Hampton, Conn.

The Standard Electric Company, of Vermont, are one of the New England enterprises which have come more prominently before the public during 1889, having during the past year pushed briskly their new dynamo. During the experimental period they confined themselves chiefly to equipping factories and towns near home, in Northern New Hampshire and Vermont. When, as their enterprising manager states, they had found they had "the best thing on earth" they came to the "Hub" and prepared to sell their dynamos wherever a market could be found. Probably the popularity of their system is best shown by the continued applications from electrical people in other cities for agencies. These dynamos, it is claimed, for an equal number of lights, run at about half the usual speed, weigh about one-third, and have in their construction only about one-fifth of the copper. As a proof of their substantial construction may be mentioned a curious accident which occurred to one of them. By some extreme carelessness of one of the workmen, an iron tool was left lying across the two binding posts when the dynamo started up, thus short circuiting the armature. The dynamo soon generated sufficient current to completely burn off one of the binding posts, without in any way deteriorating the armature, and when temporary connections were made the lights burned all night as usual. On another occasion the box supporting one of the journals was destroyed in some mysterious way, and the armature actually revolved on the fields as a support. Numerous holes were burned into the armature, but as soon as the bearings were re-adjusted the dynamo carried its full load as usual, without any repairs.

The Simplex Electrical Company have just completed the removal of the entire plant of their factory at Providence to their factory at Cambridge. Previous to the removal the machinery had all been duplicated, but Dr. Mason and the directors thought that the business could be better handled if plant were brought into closer proximity with their largest factory. The Simplex Company have now two factories, one at Cambridge and a somewhat smaller one at Watertown, Mass. Dr. Mason, who is the life and soul of this company, informs me that, by actual figures, their business in November and December of 1889, has been largely in excess of any four months of 1888, so that their business in the last year has more than quadrupled. They are now actually making about 250 miles per week, from 0000 B. & S. gauge down to the smaller sizes. The great bulk of their wire is shipped in carloads, of from forty to sixty miles, and it is no uncommon thing for them to receive orders in one day amounting to 200 miles. One of the most important changes they have made in the past year was the introduction of rubber working machinery, by which they are now enabled to make a very high class rubber insulated wire, which recently received a very high indorsement after careful test by one of the professors of a technical college. The tests then made showed an insulation of over 1,700 megohms per mile. Dr. Mason states that there is every reason to believe their business will amount this coming year to $2,000,000. They have just ordered 100 new braiders, chiefly from the New England Butt Company, of Providence, and will order 100 more as soon as the first lot are delivered.

The Thomson-Houston Electric Company.—To get an idea of the magnitude of electric light and power interests one has but to step into the offices of the Thomson-Houston Electric Company and watch a staff of over 100 persons actively engaged in the clerical work of this vast company. It is interesting to know that within the past year the business of the Thomson-Houston Company has been more than doubled. The isolated department has enjoyed wonderful success in the hands of Mr. James R. Magee, whose shrewd business qualities and genial manners have recommended him to all who do business with him. The motor department has been formed into a separate company, and the management placed in the hands of Mr. H. C. Spaulding, who has made many successful installations in mills and mining plants. The electric hoist has also been brought out this year by this department. The electric railway department, with Capt. Griffin at the head, was organized on July 11, 1887, when there was one Thomson-Houston road running. Now there are some 85 roads in operation or in course of construction. The factory at Lynn has been largely increased by new car shops, storehouses, shipping rooms, foundry, and large and new handsome offices are now in course of construction. The number of men now employed at Lynn is close upon two thousand—sufficient to show the phenomenal success which this company enjoys. Mr. C. A. Coffin still holds the guiding reins of the company in his hands, ably seconded by Mr. S. A. Barton, formerly of Chicago, while Mr. Garfield holds the responsible and onerous position of treasurer. At the factory Professor Thomson reigns supreme, and he is its main spring. It is not possible to enumerate here the many new developments of the company, nor to mention the many men who help along the Thomson-Houston interests, but sufficient has been said to show that the company still maintains its high position as a producer of electric apparatus and organizer of electric light and power interests.

Tripp Manufacturing Company.—Within the past year the Tripp Manufacturing Company, of Boston, have turned their attention to providing an anti-friction journal especially designed for use on electric cars, dynamos, motors, trolleys, countershafting, and for general use in any place where it is desired to reduce loss by friction. Electrical engineers are fast becoming aware that economy must be practiced not only in the careful construction of dynamos and electrical apparatus, the insulation of line construction, the economic production and use of steam, but that care must be taken to reduce in every way possible losses by that powerful

factor, friction. The Tripp Manufacturing Company have offered to the electric public an anti-friction bearing which on actual test by disinterested experts saves from 30 to 70 per cent. of the power usually consumed in friction, and they have met with so much success that they have found it necessary to provide themselves with a large and well-equipped factory in Commercial street, near Harrison square, Boston. Hitherto these bearings have been made by contract by outside parties, but business has so increased within the past few months that they have been forced to secure premises of their own. Besides the manufacture of the Tripp anti-friction journal, they will at once begin to make complete trucks for steam, horse and electric cars. This truck will, besides being fitted with the anti-friction journals, possess some entirely novel features, being extremely simple and accessible in its parts and prominent railway men have heartily indorsed it after careful inspection. Several of the largest electric railroads have already placed orders with the Tripp company. As an example of great saving to be derived from the use of the Tripp bearing, a motor armature shaft was recently fitted with them, which weighed 250 pounds. It was found by actual test that eight ounces pull was sufficient to rotate the shaft. One of the most recent applications of this bearing is to trolley wheels, and I recently saw one which had run 2,900 miles, until the wheel was completely worn out. On close inspection it was impossible to observe the slightest sign of wear in the rollers, and the success of this application is complete. Business prospects for this company for the coming year are very bright.

Walworth Manufacturing Company.—Among the great number of general engineering establishments throughout the country deriving a large portion of their business from the electrical industry, there is probably none which has just completed a more favorable and successful year than the Walworth Manufacturing Company, of Boston. Iron or steel poles for carrying electric wires have been used for some years, but it is only within the last year or so that the demand for a strong, serviceable and graceful iron or steel pole has become so great. The more electric companies in cities go into the business of furnishing electric light and power the more they see the necessity of providing something more graceful and permanent—looking than the old wooden pole, which has stood the "battle and the breeze" so long, but which in the larger of our cities will soon be consigned to oblivion. Recognizing this fact, the Walworth Manufacturing Company early placed themselves in a position to be able to furnish, on short notice, steel and iron poles for all classes of electrical work, and are now carrying a stock of these poles ready for immediate shipment amounting to about $150,000. That their policy was far-seeing and in the right direction is amply testified to by the fact that in the past year over $250,000 of these poles have been supplied to various electric companies, and I am informed that orders for poles amounting to a similar figure have already been received for the coming year. The Walworth Company have recently designed a very neat pole to stand in the centre of the street, for carrying the trolley wire over each track, on a double-track road. They are also putting on the market poles for electric light purposes, with steps and lamp hood complete, and have recently received orders from the West End Street Railway Company for an extension of the poles supporting the span wires, with cross arms so as to carry feeder wires or any other electric wire desired. Of the two classes of poles, iron and steel, the steel pole is the favorite, and it is made of hard Bessemer steel, capable of being welded, if desired, instead of jointing in the usual way. These poles are rapidly being adopted, and an enormous business is anticipated in the coming year, as it is evident that cities are becoming anxious to adopt one uniform system of overhead construction which will embrace all the electric wires which are intended to be carried overhead.

The Boston Electric Company, who are well known throughout the country as manufacturers of electric gas lighting apparatus, have just been allowed a valuable patent for an apparatus for immediately lighting up fire engine houses when the first blow of the fire alarm bell is struck. All the burners in the house are instantly lighted by this apparatus, and yet when desired each and every burner can be lighted at will as required, without in any way disturbing the automatic arrangement for lighting when an alarm comes in. Malden, Mass.; Fall River, Mass., and Manchester, N. H., have adopted this new device, and the two new stations at Haverhill have been fitted up with it. The apparatus is contained in a handsome case with glass front, about twelve inches high, nine inches wide and four inches deep. An electro-magnet is inserted in the main circuit, the armature of which, when there is no alarm signal being given, is always held close to the magnet, as fire alarm systems are run on closed circuit work. Attached to the armature is a small lever which has attached to it a brake, resting on a friction wheel, connected with the train of wheels which works the gas lighting apparatus. The train of wheels is set in motion by ordinary clock work and spring, and is prevented from moving as long as the armature is held up. When the first signal comes in, the armature drops far enough to be out of the attractive power of the magnet, when the following stroke is made and allows the clock work to be set in motion. A projecting pin on another disc, which only makes one revolution while the apparatus is at work, by coming in contact with the other end of the lever, then lifts the armature into position again within the magnetic influence of the electro-magnet, a local circuit is closed by a second electro-magnet, and the current is sent to each burner by a revolving switch on the same spindle as the disc with the projecting pin. This switch touches a number of contact pieces ranged in a circle, each one of which is connected with the wire leading to the various burners. The apparatus is extremely simple, positive in its action, and works with perfect success, and is well worthy of inspection. Each burner can then be turned off at will without in any way interfering with the automatic arrangement. The Boston Electric Company are extremely busy, and their sales for their automatic electric gas-lighting burners have exceeded all expectation during the past year. Business is also exceedingly brisk in all their other specialties, and they are working nights at present on the manufacture of bells, annunciators and general electric apparatus.

Samson Demands a Larger Store.—For some time past it has been apparent to the most casual observer that the Electric Gas Lighting Company of Boston have been somewhat hampered in their rapid strides onward by want of room in their old quarters on Arch street, and it is gratifying now to note that Col. Geo. W. Burnham, with his usual far-seeing and broad business policy, has succeeded in securing new quarters for his rapidly increasing business at 195 Devonshire street, Boston, which will certainly, in general convenience and elegance of design and comfort, be second to none in the country. The new store reaches from Devonshire street right through the building to Arch street, measuring 80 feet long, 25 feet wide, with a rear entrance, and freight elevator accommodation at 56 Arch street. There is also a large and well-lighted basement, reaching from street to street, and the combined space of the two floors amounts to 3,500 square feet. On the Arch street end of the store is the director's and manager's private office; and on the Devonshire street end is the private office of Chief Clerk W. W. Burnham and the general office for the accommodation of the bookkeeper and his assistant, entry clerk, shipping clerk and stenographers. The main store is fitted up in stained cherry wood, and contains every convenience for large stock in the shape of drawers, shelves, bins, etc. In the middle of the store is a dumb elevator and spiral staircase for communication with the basement, and a telephone closet. In the basement special shelving is arranged to accommodate about 20,000 Samson batteries complete, and a large stock will always be kept in reserve. Everything has been fitted up with a view to the most advantageous and prompt handling and shipping of goods. Sample boards have been erected in the store with different appliances, and make an interesting display of the company's manufactures, and there are ample show windows, both on Devonshire and Arch streets for the exhibition of the company's manufactures to the passers-by. The electric gas lighting business is one which has met with more bitter opposition and protracted litigation than almost any other electrical industry, but it is fast becoming one of the most important domestic electric industries of the country, and Mr. Burnham, although now backed by a strong board of directors, deserves great credit for his untiring and conscientious efforts to bring the Electric Gas Lighting Company to the position of success which it enjoys to-day. Within the past 18 months the business of the company has more than doubled itself, and the history of the company since 1881, when Mr. Burnham first took hold of it, has been one of hard fought and deservedly won success.

Electricity and the Lawyers.—I had the pleasure this week of a call upon James T. Davidson, at No. 7 Exchange place, Boston. Mr. Davidson, as a lawyer, is giving special attention to legal work for electric companies and firms. He had a hand in the pioneer fights in the West when the old line companies sought to keep out the electric light companies by crying "induction," "death" and "fire." A few years ago this gentleman temporarily gave up his law practice and district attorneyship in order to make special preparation for the practice of electrical law. He took a two years' course in electrical engineering and later spent two more years in practical construction and laboratory work. Mr. Davidson is already figuring prominently in electrical litigation and has recently located in Boston to follow this special branch of his profession, where he will be warmly welcomed by the electrical circle. There certainly is a need not only for special practitioners in electrical law but, without disparagement of our courts, the wish may reasonably be expressed that some of our judges might be better qualified with a special education for hearing electrical controversies in law and equity. "I am reminded," says Mr. Davidson, "of a recent patent infringement suit which involved intricate electrical questions. The case was being heard before one of the ablest circuit judges of the United States Court. When the counsel were about to proceed with the argument, and a Gatling gun loaded with ohms, volts, ampères, magnetic lines of force, shunts, solenoids, etc., was about to be turned upon the judge, the latter, with an expression of despair, interrupted the progress of the case, saying, 'Gentlemen, if you desire me to be convinced you must first instruct me.' Then they sent out for a bottle of iron filings, magnets, needles, galvanometers, solenoid, spools, cells, etc. For a whole day the learned judge was the pupil of this court's clients. Take, for instance, an equity suit where an intricate electro-mechanical question is vital to the issue, how can a good lawyer protect his client's interest unless he has educated himself in the theories of electricity and magnetism in their relations to modern mechanics? How can he skillfully combat experts giving prejudiced or fallacious testimony? How could he build the strong points of technical evidence into a fabric for his own use, or tear asunder that of his opponent, if he did not first understand not only electrical theories, but their practical relations to modern electric machinery? These considerations, I think, show the cogency of the reason why there should be a special practice in electrical law, if I may use such an expression. Cannot reasons of a like nature be named why the judge should not also be technically educated in order to have that digestive ability necessary to weigh electro-mechanics in the scales of Justice?"

West End Steet Railway Company.—President Henry M. Whitney, of the West End Street Railway, in the shape of a New Year's message in the Boston *Globe*, has made the following statement: "There is no other man in this neighborhood who has as many customers every day as President Henry M. Whitney, of the West End horse railway, and therefore his New Year resolutions and plans are of expectional public interest. When urged yesterday to give the readers of the *Globe* a New Year message, Mr. Whitney was kind enough to say: 'The railway company have, within the last day or two, purchased the property in Cambridge of the New England Glass Company, where they intend to place their power plant for the operation of electric cars in Cambridge, Charlestown and Somerville. The property is well adapted for immediate use, as there is a large chimney sufficient for 6,000 or 7,000 horse power, buildings suitable for engines and boilers and a wharf for landing coal. The company have already contracted for about 2,000 horse power in engines to be placed in this power house, which will be sufficient for immediate needs, and hope to have the plant in operation early in the summer. The directors have recently authorized the purchase of 200 open cars, thereby adding nearly 25 per cent. to our open car equipment, and are expecting to contract for a large number of additional box cars to be ready for another winter. The growth of the passenger business is so rapid that it is difficult for the company to provide equipment rapidly enough to meet the demand. The number of passengers carried per day has averaged for each day in December nearly 50,000 a day more than in 1887. So far as I am able to judge from expressions of opinion by all communities that are now reached by the electric cars, the electric system is giving most excellent satisfaction, and we are solicited to extend the system from all quarters. The lines from Park square to South Boston, and from Egleston square to Forest Hills will be among the first to be equipped the coming year. The Egleston square line, itself, will probably be opened between this and Feb. 1. The company have contracted for a large number of rails, and hope to begin their work early in the season, and to finish it early in the fall, before cold weather sets in. The great difficulty which the company meets in its transportation service is the crowded condition of the streets down town, and the board has been considering some means for the relief of this trouble. It is evident to almost every one that some means must be provided for more rapid transit through the city proper, and it is believed that we can suggest a plan which will relieve this difficulty to the general satisfaction of the community.'" The impression is that the plan referred to by Mr. Whitney is an elevated electric system to be run by electricity. The elevated portion of the structure would probably only be in the city proper, the elevation of the railroad gradually declining to the level of the streets after leaving the busiest parts of the city, where sufficient speed could be attained on the ordinary surface railroad. In confirmation of his plan it is well known that the Thomson-Houston Company, in conjunction with the West End Company, are building at Lynn an electric locomotive, which will be entirely devoted to traction purposes and have no seating capacity for passengers.

A. C. S.

Providence, R. I., Jan. 7, 1890.

The Armington & Sims Engine Company report an increase of 25 per cent. in business as compared with 1888, and furnish the following statistics: In 1884 their average production was an engine of 15 h. p. per day; now it is 125 h. p. per day. During the past year two important additions have been made to their extensive works. One is a steam laboratory, the most perfect of its kind in this country. It is provided with a safety water tube boiler that carries a pressure of 200 pounds to the square inch. A vertical brass graduated standard is placed beside the glass water gauges at each end of the boiler, so that no matter what the water level may be, its weight may be determined at once. Automatic flue dampers permit of only two pounds variation of steam pressure. The engine foundations are built of brick, faced with large cast-iron floor plates, planed. An improved condenser is used, together with two dynamometers or friction brakes whose loads can be varied instantly from 5 to 200 h. p. Water is the lubricant used, and dash pots prevent sudden variations. Four pounds added to the point of suspension on the break will give a load of 1 h. p., which is verified by Tabor indicators. Tachometers driven by belts, and hand speed indicators, give the number of revolutions. Army and navy officers conduct all tests of engines required by the government for its various departments. The laboratory is turned over to them to do with as they please. The economical and actual results obtained should prompt other builders of engines to know exactly what their productions are capable of. The other building of one story is an addition to their machine shop, containing about 15,000 square feet of ground floor space. Unlike many other Providence corporations and individuals the Armington & Sims Engine Company had its buildings, and every machine that could possibly be made, built and constructed by Providence firms. Part of the machinery was furnished by Brown & Sharpe, and Nicholson & Waterman, Providence; Pond Machine Tool Company, Plainfield, New Jersey; Manning, Maxwell & Moore, New York City. The cost of buildings and machinery has been a trifle over $50,000. Among the engines of new and special design made for the government during the past year may be mentioned those running 800 revolutions per minute for torpedo service, and those of 450 revolutions, connected directly to dynamos without belts, for all of the new cruisers, each of them having from one to three on board. Double compound engines, with grooved wheels using 1½ inch ropes for the transmission of power by ropes in place of belts have been put in the new gun shops of the Washington Navy Yard. The most radical departure of all is, after an experience of four years by the Washburn & Moen Manufacturing Company, Worcester, Mass., to order a second compound engine of 1,000 horse power to run from 250 to 300 revolutions per minute, to drive a train of rolls direct in their new mill. This engine will weigh, without pulleys or wheels, 130,000 pounds. They report the outlook for business during the coming year as excellent.

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building. Philadelphia, Jan. 11, 1890.

Personal.—Mr. Henry Hine, of New York, General District Agent of the Westinghouse Electric Company, the United States Electric Lighting Company and Sawyer-Man Electric Company, was in this city on Wednesday.

Seamless Tubing.—The Spring Garden Metal Works, corner Tenth and Spring Garden streets, this city, make a specialty of seamless, brazed and open-jointed tubes in brass, copper or German silver, in any length or size, from one inch in diameter to a size as small as a cambric needle.

The Equitable Electric Railway Construction Company is the name of the new corporation in this city, which becomes successor to the well-known firm of Chadbourne, Hazelton & Co. The officers are: A. H. Chadbourne, president; W. A. Stadelman, vice-president, and William Hazelton, secretary and treasurer.

Geo. W. Porter, of this city, is very busy (day and night) attending to correspondence and other duties in connection with his position as local manager of transportation to the Kansas City Convention. Mr. Porter has convinced several Philadelphia "can't get aways" that there is certain cure for La Grippe in the ozone atmosphere of Kansas City.

Stamping Letters by Electricity.—The Philadelphia Post Office has in use a machine run by electricity (Sprague motor, of ⅙ h. p.), which will cancel about 20,000 letters an hour. The machine is the invention of, and manufactured by, Messrs. Hey & Dolphin, of Syracuse, N. Y. Similar machines have been placed on trial at the post offices in New York, Boston and Chicago.

The International Printing Telegraph Company gave an exhibition of its machine at the company's shops in Camden, N. J., on Thursday, Jan. 9. The system is the invention of Mr. J. H. Linville of this city, and is more familiarly known as the Linville system of printing telegraphy. It was on exhibition at the Equitable building, New York, for several months in the early part of last year.

The Cleverly Electrical Works report through their manager as having an unprecedented rush of orders on electric gas lighting apparatus. An additional foreman and several more workmen were employed by Mr. Cleverly this week, and the force is not yet large enough to enable the company to get ahead of its orders. Electrical supply dealers in the South and West are respectfully requested to send their address to H. M. Cleverly, 1,018 Chestnut street, Philadelphia.

Chadbourne, Hazleton & Co., of this city, agents for Pennsylvania, Maryland and Delaware for the Sprague Electric Railway and Motor Company, have taken a suite of handsome offices at Nos. 416, 418 and 420 Walnut street. The suite comprises four large and nicely arranged offices, three of which occupy the entire front of the third floor. Electric lights or gas may be used at will. The combination fixtures and electroliers are of highly artistic design, in antique brass. Every room in the suite is supplied with modern conveniences, while two rapidly running Otis elevators bring the offices within easy access.

The Westinghouse Electric Company's Philadelphia office has the following plants now under construction, viz.: North Penn Junction, Pa.—Jas. Long, Bros. & Co., 800 lights, one Westinghouse engine; Schaum & Uhlinger, 200 lights; Phillips, Townsend & Co., 200 lights. Philadelphia, Pa.—Quaker City Cold Storage and Warehousing Company, 500 lights, two dynamos and two Westinghouse engines; W. A. Haines, 200 lights; G. & H. Barnett, 300 lights, Westinghouse engine; Keen, Sutterle Company, Ltd., 250 lights. Parkesburg, Pa.—The Parkesburg Iron Company, 150 lights, one Westinghouse engine. Woodbury, N. J.—The Wells & Hope Company, 400 lights. Bridgeton, N. J.—East

Lake Woolen Company, 200 lights. Central Stations—Allentown, Pa., 1,500 lights; Bethlehem, Pa., 500 lights; Lynchburg, Va., 750 lights.

Bijou Electric Light Plant.—The isolated electric light plant at the Bijou Gaiety Theatre, in this city is one of the most creditable of installations of the kind. The Jarvis Engineering Company, of Boston, put in the steam plant, which consists of a 50 h. p. Armington & Sims engine, a 60 h. p. Babcock & Wilcox boiler a Worthington pump and a Webster vacuum feed water heater. The engine is connected to a powerful countershaft by an Ireson link belt, and the shafting drives two dynamos, *i. e.*, a Thomson-Houston direct current incandescent machine of 400 (16 c. p.) lights capacity, and a 20-light Brush arc machine. The dynamos, switchboard and entire electric connections were installed by Mr. Fred A. Swan, the popular and expert electrician, of Boston, assisted by Mr. H. P. Rockwood, of the same city. The lights were started up on Aug. 15, 1889, and have since been running at an average of 16 hours a day without a skip, and without the least trouble of any kind. This is undoubtedly a model plant, and it reflects great credit on those identified with its installation, as well as those who furnished the equipment.

A. Whitney & Sons, of Philadelphia, after many years of experiments with different forms of chilled iron, have at last perfected a device for a uniformity of density in the chilled surface of car wheels. This invaluable device is the invention of Mr. John R. Whitney, the senior partner, and it has been covered by several patents. It is set forth in the patent specifications as "The Whitney Contracting Chill, for Casting Car Wheels." With railway officials in general and with promotors of electric railway enterprises in particular, this new process of enhancing the strength and durability of car wheels should at least merit some attention; and Messrs. Whitney & Sons will cheerfully and promptly reply to all inquiries. This firm have letters from several street railway companies, which I have seen, stating that "the car wheels under the present process of the Whitney contracting chill have given largely increased service, and in some cases double what was given under the old style of chilled wheels." In a recent order of 5,000 wheels delivered to the Savannah, Florida & Western Railroad, 4,439 were of exactly the same circumference, the remainder not varying over 1/6 of an inch either way. Not a single wheel was rejected from the whole number furnished on the score of imperfection in workmanship or material.

Electrics at Media, Pa.—The electric light station at Media, Pa., was started a month ago, and has been running ever since in first-class shape. The station is a very fine brick building, with stone foundations extending to the floor lines. The boiler room contains three tubular steel boilers, built for a working pressure of 120 pounds to the square inch, delivering steam to two Westinghouse compound engines, cylinders 9 inches and 15 inches by 9 inches stroke. These drive two No. 1 Westinghouse A. C. dynamos and one 35-light new Wood machine. The pole line practically covers the whole borough, the poles being chestnut, averaging 35 feet high. The outside lines are "Simplex" wire throughout, and are calculated for a drop of two per cent. with 2,000 lights burning. The whole installation is one of the best, the switchboard and station detail being of the finest. The company has a contract for furnishing the borough with lights, and should certainly do well, Media being a very good lighting territory. The company is said to be arranging to run its lines as far as Wallingford, to light up a number of the handsome residences in that section, and have already contracted for over 1,500 lights. Mr. H. C. Howard is president, Mr. John C. Cummins, secretary, and Mr. John T. Reynolds, treasurer. Messrs. M. R. Muckle, Jr., & Co., of this city, sold and installed the entire plant, with the exception of the arc-light machine and lamps, for which, however, they ran the circuit. The whole plant is a model one, and is one of the few stations in Pennsylvania with which Mr. Braddell, in his late tour of inspection, had no fault to find.

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Jan. 11, 1890.

Mr. J. R. Jones, of Shreveport, La., was in the city last week.

Mr. E. J. O'Beirne, of New Orleans, dined at the club rooms last week.

Mr. P. C. Burns, manager of the St. Louis Electrical Company, was in Chicago last week.

Mr. H. E. Olbrich, of Cedar Falls, Iowa, has brought out an electric governor for water wheels.

The Shultz Belting Company, St. Louis, are sending out quite a handsome calendar for 1890.

Mr. W. M. Talcott, of Chicago, has been appointed special agent for the Charles D. Jenney motor for this section.

The Southwestern Electrical Supply Company, Kansas City, Mo., are sending out a handsome calendar to their many friends.

Mr. A. H. Bauer, of the Pullman Company, left for New York on Thursday's limited to arrange certain matters connected with train lighting.

Mr. P. C. Ackerman, of the American Electrical Works, has favored this office with one of the valuable reference calendars issued by his house.

The Kansas City Electrical Society met at the Midland on last Saturday evening, and after transacting some business adjourned till the 18th inst.

Mr. Nat. G. Warth, formerly manager of the local telephone exchange at Zanesville, O., has been appointed manager of the telephone exchange at Des Moines, Iowa.

The American Wheel Works, Indianapolis, have installed a 30 h. p., Chas. D. Jenney constant potential motor for driving certain machinery within their works

The Western Electric Company's proposition for furnishing an electric light plant with a capacity of one thousand 16 c. p. lights for the Bridewell has been accepted. It will cost $4,875.

Mr. Gilbert M. Smith, manager of the Chicago office of the Ansonia Brass and Copper Company, has returned from a holiday visit to his Eastern friends and is again lunching at the club rooms.

Mr. C. C. Perry, of Indianapolis, was in town last week purchasing supplies for his central station incandescent plant that is gradually being enlarged to accommodate the demand for current.

Jacksonville, Ill.—Dr. P. G. Gillette, superintendent of the Deaf and Dumb Institution, has just received a new 50 h. p. Ideal engine from Springfield, Ill., for the use of the electric light plant of the institution.

The Citizens' Electric Supply Co. has been incorporated at East St. Louis Ill., to manufacture electrical apparatus and supplies. Capital stock, $1,000. Incorporators: H. D. Sexton, I. B. Sager and Martin D. Baker.

Mr. Charles E. Hamill, Secretary of the Massillon (Ohio) Electric Light Company, and a popular and promising young business man, died on the 6th inst. of pleurisy. Mr. Hamill was unmarried and but 22 years of age.

The Citizens' Electric Street Railway Company, at Champaign, Illinois, have organized to operate a street railway; capital stock, $150,000; incorporators, J. W. Davidson, W. S. Rayburn, Daniel Morrissey and others.

The Central Union Telephone Company connected in twenty new subscribers during the month of December in the town of Findlay, O., which speaks well for both the local manager and the progressive enterprise of the citizens.

Mr. C. K. Mead, formerly manager of the Central Union Telephone Exchange at Des Moines, has been appointed city electrical inspector. Mr. Mead still retains his interest in the local messenger and district telegraph company.

Mr. C. C. Hatfield, president of the Indianapolis District Telegraph Company, and his entire staff surrendered to "La Grippe" during its late visit to that town, and the citizens had ample opportunity to appreciate how perfect was the service previously rendered.

Mr. W. S. Gorton, of the Thomson Welding Company, is installing an 80 h. p. alternating generator and exciter and two welding machines in the shops of the Parry Rood Cart Company at Indianapolis, where they will be used for welding wheel tires and for similar work.

The Southern Electrical Supply Company, St. Louis, W. C. McKinlock, secretary and treasurer, have been forced to remove from their old quarters and have gone into a commodious and substantial five story brick building at 823 Locust street, beteewn Eighth and Ninth.

Damage by Fire.—The Allegheny Telephone building, at Pittsburgh, and the Chicago Telephone building were both very slightly injured by a fire occurring among some waste paper on Friday and Saturday, respectively, of last week. Too bad that the alarmists could not trace the cause to a crossed electric light wire!

Col. J. H. Shay, of the Charles Munson Belting Company, Chicago, entertained a jolly party of thirteen of the fraternity at McVickers on New Year's Eve, and after the performance saw the new year come in while enjoying a lunch at the club-rooms. Colonel Shay takes a very hopeful view of the belting business for the current year.

Mr. P. S. Kingsland, manager of the Chicago office of the Phœnix Iron Works Company, closed the old year with three heavy contracts, and opened the present year with the sale of two complete steam plants. Mr. Kingsland reports that his sales of the Dick & Church engine to electric light companies during the past year have been unusually large.

Mr. George E. Fisher, secretary of the Commercial Electric Company, of Detroit, while in Chicago last week referred to the large number of Mayo incandescent dynamos they were installing and to the perfect regulation of the machines. Mr. Fisher also remarked that there was every prospect of the year being an unusually prosperous one for the electrical industries.

Wm. Baragwanath & Son report about 30 per cent. more business last year than in any previous year. As an indication of the character of their trade, they report that during the year they turned out 35 heaters of a capacity of 800 h. p. each and upward, besides hundreds of the ordinary sizes, ranging from 15 to 600 h. p. They also have a very large demand for their superheaters, which are being introduced very extensively into electric plants.

Mr. F. W. Horne, of the railway department of the Thomson-Houston Electric Company, has secured the contract for equipping the lines of the Elgin City Railway Company with the Thomson-Houston electric system. The directors of the road have visited and carefully inspected many different roads during the last four months, and Mr. Horne is to be congratulated on securing this contract, more especially as it was his maiden effort in railway work.

Shay, Stephens & Co., Chicago, are bound to make a record for themselves before the close of 1890, as they secured contracts during the first four days of this year for over 200,000 porcelain insulators and 1,000,000 glass insulators. Then there was an order for some glass battery jars, 16½ inches wide by 11½ inches deep. No wonder "Charlie" Stephens can smoke a pipe having a glass stem six inches in length, or that he presents a handsome "La Tosca" glass cane eight feet in length to every lady that visits his office.

Mr. Charles D. Jenney, of Indianapolis, will be present at Kansas City in February, and have one or more of his new type of motors on exhibition. Mr. Jenney has recently placed a one h. p. motor for driving sewing machines; a five h. p. motor for elevator work; and delivered a two h. p. motor to the University of Pennsylvania. A Jenney motor, installed last July, has been in nightly operation driving a 48-inch ventilating fan without requiring the slightest attention or even a renewal of brushes.

A Town Financially Embarrassed.—A press dispatch from Bloomington, Ill., of Jan. 4 says: The city authorities last night compromised their differences with the Fort Wayne Jenney Electric Light Company by paying the company $1,000, the company to make several concessions in the way of alterations in machinery. The council meeting last night was red hot. Mayor Mason stated that he had found it impossible to borrow money on the city's credit in the banks of Bloomington. The council has expended almost all that the city can legally raise by taxation, and money is urgently needed.

Mr. D. A. Rauck, a prominent banker of Fremont, O., and president of the Fremont Electric Light and Power Company, has purchased the gas company's plant at the reported figure, $41,150. Mr. Rauck says: "The object of the purchase was to protect our own interests from outsiders. The price of gas will not be raised from the present rate per thousand. The intention of the company is to move their power house from the present quarters on Wood street to the gas factory. New engines will be procured and other improvements on the plant made. The company will then be able to use gas, coal, coke or oil for heating their boilers. Now they have gas alone."

The Knapp Electrical Works, Chicago, though occupying the ground floor and basement and the two upper floors of the large double building at 51 and 56 Franklin street, find themselves again crowded for room, and are making extensive changes and alterations that will add materially to the general appearance of the first floor, afford greater office room, and provide better facilities for storing and handling the enormous stock of Grimshaw white core wires that they are actually compelled to carry in order to supply the demand. Speaking of his location, Mr. Knapp says that the completion of the West Side cable lines would probably bring about an entire change in the class of travel on Franklin street, and tend to convert it more into a retail section, and also increase the value of property in that portion of the city, which has risen highly in the estimation of real estate dealers since the erection of the handsome telephone building, as evinced by the payment of $200,000 for the Fuller & Fuller building and lot.

F. DE L.

CANADIAN NOTES.

TORONTO, Jan. 6, 1890.

The Vancouver Electric Railway and Light Company has been organized.

The Brush Electric Company have sold at Barrie a plant of 500 alternating incandescent lights.

The Edison Company has been making an increase in the Calgary station, Winnipeg, from 500 to 1,000 lights.

The Fort Wayne Jenney Company have sold plants, alternating, at Port Hope, Collingwood and Coburg, Ont.

The Westinghouse Company have sold to A. Harris Sons & Company, of Brantford, a plant of 400 lights, direct system.

The Hamilton Electric Light Company will be reorganized and the facilities increased. It seems likely the gas company will not enter the field under the circumstances.

The Royal Electric Light Company, of Montreal, have increased their plant at Quebec from 500 to 1,500 incandescent alternating. Montreal has been increased from 1,000 to 2,000. They have sold a plant at Guelph of 500 lights, and at Toronto 500 lights.

Montreal.—It is reported from Montreal that the parent Edison Company propose to erect there a large station with funds of their own. Not only there, but in Buffalo, a $1,000,000 station is, it is said, projected, and one at San Francisco of equal size. If reports are true, the Edison Company will accomplish most substantially their belief in the Edison systems as a paying investment, not only in the places mentioned, but all through the United States.

The Toronto Edison Company have been pushing matters in connection with their station, and expect to start soon. In connection with that company, Hy. S. Thornberry & Co. are doing an extensive business in wiring. Mr. Edison is reported to have been examining the copper mines in the vicinity of Modoc in connection with the electric ore-extracting system he is working out, by means of which he expects to extract 12 per cent. copper at a profit.

A Carbon Factory —With the growth of electrical industries in Canada, a new factory for us is about to be constructed at Peterborough. That municipality has granted a loan for the erection and maintenance of a carbon factory. That such a works is needed there is no question. Electric lighting in Canada, however, has not yet reached such a state of development to promise success to any large works of the kind. Among our, until now, representative electrical industries in that line has been that of the Hibbard Electrical Works. Presently the firm became involved and the stock and machinery has been sold, for the benefit of its creditors, to Mr. James Leggatt. The amount realized for creditors will, however, be small.

K.

THE TELEGRAPH.

The Great Western Telegraph Company.—It has again been decided that the 3,600 or more stockholders in the above defunct company must meet their liabilities as to unpaid subscriptions, etc. The amount is heavy, and a number of leading men are interested.

St. Louis, Mo.—The Western Union Telegraph office in St. Louis was destroyed by fire on Jan. 8, the fire having started, it is said, in the basement or engine room. Some of the operators had a narrow escape. The wires are a total wreck, and the Associated Press office is also a ruin.

The Halifax-Bermuda Cable.—A special dispatch from Ottawa of Jan. 3 says: "Mr. F. Gisborne, of the government telegraphic service, to-day received a letter from the Bermuda Cable Company, stating that the imperial government had extended the time for the completion of the line to June 24 next. The whole of the cable is ready and in the tank at London. It will extend from Halifax, N. S., to Bermuda. Mr. Gisborne expresses his conviction that this company will doubtless carry out his original project of a line from Halifax to Bermuda, thence to the Bahamas, and finally to Jamaica."

The Commercial Cable Company paid their usual quarterly dividend of one and a half per cent. on Jan. 2, last. The New York *Times* says: "The report of the Commercial Cable Company for the quarter ending Dec. 31 shows that during the three months of October, November, and December the company's gross earnings aggregated $495,189, the quarter's net earnings being $320,187. For the entire year of 1889 the company's gross earnings were $1,789,387, out of which there were left net earnings of $1,089,379. The annual interest charges were $140,256 on $2,337,600 debenture six per cent. bonds. The company transferred to its sinking fund $200,000, making, with the interest charge, a total of $340,256, which leaves for the year $749,123 (or more than 11 per cent.) applicable to the company's capital stock."

THE TELEPHONE.

The Southern New England Telephone Company have issued a neat desk calendar, giving a map of their circuits throughout Connecticut.

The Edison Phonograph Works at Orange, N. J., are running on a lot of 50,000 dolls, all of which are to have phonographs placed "in their little insides."

The East Tennessee Telephone Company is to put up an exchange building at Knoxville, install a new switchboard and make other changes aggregating an outlay of $20,000.

Government Telephone in Europe.—The action of France with regard to telephone appears to be contagious, and it is now announced that the Italian Government intends to monopolize the telephone system in that country. The British Postmaster-General also has designs on the English telephone companies.

The Phonograph in the Belfry.—The New York *Sun* has the following item: "On Tuesday night last Mr. J. Sullivan, of the Edison Company, together with his brother and ten employés of the Metropolitan Phonograph Company, succeeded, after a great deal of labor, in getting two phonographs up in the belfry of Grace Church. Their object was to secure impressions of the chimes which were to welcome in the new year, and they met with success. Seven impressions were taken. One is to be preserved by the church, another will be sent to Paris for exhibition, and one will be presented to Mr. Edison. The rest will be used by exhibitors in the employ of the Metropolitan Phonograph Company." We have since heard these phonograph chimes. They are admirable.

People's Telephone Company.—Chancellor McGill, on application of Thomas B. Harned, of Camden, N. J., has issued an injunction to Joseph F. Stokes, John M. Sharp, Godfrey Keebler, Charles S. Sharp, Jacob S. Duvale, William B. Johns, Thomas Firth and James Ritchie, Jr., their attorneys or agents, ordering them to desist from selling, or otherwise disposing of, all of the due bills and stock issued as collateral, and restraining them from as-

signing any of the stock of the People's Telephone Company, which they or any of them may own. The injunction was the outcome o dissatisfaction among the members over the election of the above-named gentlemen as directors. The meeting was held in Camden in August, when it is said that the proxies amounting to about 400,000 shares were prevented from being voted.

THE ELECTRIC LIGHT.

Ocala, Fla.—The plant to be put in is of the Thomson-Houston system.

The Washington Navy Yard is to have additional Brush plant for lighting.

Carlisle, Ky.—The Nusom Electric Light Company has obtained a franchise.

Newport, R. I.—The Thomson-Houston plant has been bought by the local Edison Company.

Hopkinsville, Ky.—The Thomson-Houston Company will put in the plant for the Western Lunatic Asylum.

Paso Robles, Cal.—The Central Milling Company will put in a plant for general lighting, public and private.

San Antonio, Tex.—The San Antonio Electric Light and Power Company propose putting in a 400 h p. engine.

Topeka, Kan.—The Electric Railway, Light and Power Company has been formed with a capital stock of $150,000.

Chattanooga, Tenn.—The Southern Lumber Company want an incandescent plant of 100 lights. Mr. W. B. Seymour is president.

Dolgeville, N. Y.—It is proposed to utilize the East Canada Creek in running an electric light plant for the factories in the village.

Athens, Ga.—The Athens Gas Light Company have just intalled a 150 h. p. steam plant furnished by the Ball Engine Company, of Erie, Pa.

Wakefield, R. I.—The Citizens' Gas Light Company has obtained permission from the State Gas Commissioners to do an electric lighting business.

North Smithfield, R. I., has contracted with the Woonsocket Electric Machine and Power Company for street lighting, about 15 arc lamps being required.

Tecumseh, Neb.—The town of Tecumseh, Neb., has just ordered from the Omaha Engineering Company, agents for the Ball Engine Company, an engine to run their electric plant.

The California Electric Light Company, of San Francisco, Cal., recently purchased a 100 h. p tandem compound engine from the Ball Engine Company, of Erie, Pa., for their station.

The Edison Electric Illuminating Company, of New York, proposes to increase its capital stock from $2,500,000 to $4,500,000 to develop its business. Action will be taken Jan. 28.

Idlewood, Pa.—The Chartiers Valley Electric Light Company has been formed to light Idlewood, Grafton, Ingram, etc. W. A. Zahn is president; G. Glass, secretary, and J. J. McCormick, treasurer.

Wilkesbarre, Pa.—The Wilkesbarre Electric Light Company has put 200 incandescent Edison lamps in the new Presbyterian Church, with great success. The work was done by Messrs. Eberly and Lewis.

Norwalk, Conn.—The Norwalk & South Norwalk Electric Light Company have just installed an 80 h. p. Ball engine, sold them by Messrs. C. R. Vincent & Co., Eastern agents for the Ball Engine Company.

Lebanon, Pa.—Messrs. H. M. Sciple & Co., agents for the Ball Engine Company, are just starting up one of their 100 h. p. tandem compound engines at the station of the Edison Electric Illuminating Company, of Lebanon, Pa.

The Allegheny County Light Company, of Pittsburgh Pa., has ordered two arc light machines, Westinghouse new system, 60 lights each, of the Westinghouse Electric Company. This gives the Allegheny County Light Company a total capacity of 800 arc lights.

Incandescent Lamp Litigation.—The Edison Electric Light Company, of New York City, has filed two bills of complaint in the United States Court against the Perkins Electric Lamp Company, of Manchester, Conn. The suit is brought to restrain the defendant from manufacturing certain electric lamps, the patents on which the complainants aver are their property.

APPLICATIONS OF POWER.

Shreveport, La.—The Shreveport Railway and Land Improve. ment Company will not equip its road with storage batteries but intends now to adopt the overhead system.

The Sprague Electric Railway and Motor Company.—We understand that Mr. J. H. Herrick has been elected president of this company and Mr. S. Insull, general manager.

Braintree, Mass.—Gen. F. A. Hobart, Hon. J. T. Stevens, and other well-known citizens of Braintree, have formed the Braintree Street Railway Company, with a capital of $25,000, divided into 250 shares, at $100 each. The road will be operated by electricity and run from Holbrook to the Quincy line.

Pittsburgh, Pa.—Work is progressing on the placing of the plant in the new power house of the Second avenue electric road at Brady street, Pittsburgh. Robinson & Rea are putting in two 200 h. p. engines to run the dynamos. The Thomson-Houston system will be used on the road, and it is expected that it will be in operation very soon.

Table of Electrical Horse Powers.—We have received from Messrs. Crane & Miller, patent experts and mechanical engineers, of Newark, N. J., a very convenient table of electrical horse powers, ranging between 500 and 600 volts and 10 and 110 ampères. The table is calculated by Mr. W. F. D. Crane, M. E., E. E., which is a sufficient guaranty of its accuracy. It can be conveniently carried about in the pocket.

Motors as Window Attractions.—Mr. D. Goodin, of McKinney, Tex., writes us: "During the dull months of last summer I made two small electric motors, and in arranging my show window for the holiday trade I placed them in different places among the silverware and fine clocks. They made the best attraction I have ever had. They were built on different plans, one running at lightning speed and the other at a moderate rate, so that its action could be easily observed. I have had crowds before my window constantly from morning until late at night.

Watch Keys made by Electric Power.—An old farmer in the Granite State one Sunday morning started to wind up his great silver watch, and found that the key was filled with dirt. Being unable to dig the matter out with a pin, the farmer drilled a hole in the key, and, with a single breath, blew all the dust out. Then he sat down to think, and within a month had patented that hole. To-day, in Lebanon, N. H., there is a large factory running by electric power, wherein are manufactured daily thousands and thousands of watch keys of every possible size, shape and design. Each one of these keys contains the hole which has been patented by the farmer. The latter has already made a fortune.—*Metal Worker.*

The Westinghouse Electric Company has now entered the field of supplying electric machinery for mining purposes. A few days ago the company secured a very large contract from the Hercules Mining Machine Company of Pittsburgh, Pa., for a large quantity of generators and Tesla motors. This apparatus is to be used to operate the Hercules coal mining machine, a new device which has lately been brought out by the Hercules Mining Machine Company, and is said to possess the ability of producing coal more economically than any similar contrivance. The inventors of the Hercules have been testing a number of electric motors as to their ability to operate the machine. The result of these experiments ended favorably to the Tesla motor The Hercules is being introduced in all the different coal mines of the Monongahela Valley and a Tesla motor goes with each Hercules.

PERSONALS.

Dr. George E. Fell, of Buffalo, still maintains that electrical execution is a "proper, just and humane punishment." His tests with animals convince him of this.

Gen. C. H. Barney, the secretary of the National Telephone Exchange Association, will hereafter issue his Bulletin monthly instead of twice a month. The next number will be dated Jan. 31.

Prof. Charles R. Cross, of the Massachusetts Institute of Technology, will lecture before the New York Electric Club on Thursday evening, Jan. 16. Subject: "Some Acoustic Principles of the Telephone." The lecture will be illustrated by experimental apparatus.

Mr. Joseph Wetzler will deliver an address before the New York Electrical Society, at Clinton Hall, on Jan. 15, at 8 P. M., entitled "A Review of the Electrical Year," dealing with the practical progress made during 1889.

Prof. W. A. Anthony will read a paper before the American Institute of Electrical Engineers, on Jan. 21, at 8 P. M., at the new hall of the Civil Engineers, 127 East Twenty-third street, entitled "A Review of Modern Electrical Theories."

Mr. H. C. Spaulding, general manager of the Thomson-Houston Motor Company, lectured last week at Wells Memorial Hall, Boston, upon "Electric Power." Photos of motors used in running printing presses and mining machinery were passed around for inspection.

Mr. J. H. Wagstaff, the secretary and treasurer of the Canada Electric Company of Amherst, N. S., is already well known in electrical circles as having been District Superintendent of the Maritime Provinces for the Bell Telephone Company and afterwards general manager of the Nova Scotia Telephone Company.

Mr. C. McIntire, the inventor of the well-known McIntire joint and connector, and at one time interested in the manufacture of jewelry in Newark, died in that city last Saturday from an illness induced by "la grippe." Mr. McIntire had worked up a large business by his ingenuity and perseverance, and was deservedly held in high esteem by a large circle of friends and acquaintances.

Mr. Frank Kitton, of the Western Union Telegraph Company, at Buffalo, read a paper before the local Electrical Society on Jan. 5, giving the results of wire tests he had made. Samples of wire were put to severe tests for an extended period without in any way affecting their insulating properties. Mr. Kitton said that the most desirable covering for electric wires possessed all of these qualities: were good insulators, impervious to water, resisted abrasion, were not deteriorated by exposure, and were fire-proof to a good extent. He contended that with such wire it was possible to make aerial wires carrying high potential currents reasonably safe. He did not approve of unwise haste in placing arc wires underground.

MISCELLANEOUS NOTES.

The Signal Dispatch Telegraph Company has been formed at Nashville, Tenn., by W. M. Fleming, A. M. Chrisholm, J. A. McCleary, and others.

The National Gas and Electric Fixture Company has been incorporated under the laws of New Jersey by B. Thackara, C. M. Biddle and others, with a capital stock of $500,000.

Electrical Execution in Wax.—At the Eden Musee, in this city, in the Chamber of Horrors, a complete electrical execution tableau has been set up, with dynamo, switches, voltmeter, executioner and criminal, the last being strapped down in the chair with the electrodes at his head and neck. It is a ghastly sight, but the curious comments of the public relieve the gloom.

The Interior Electrical Conduit Company, of 154 and 156 West Twenty-seventh street, has issued a new price list of its system and materials for interior wiring. The prices quoted are so low that there should be an universal introduction of this excellent method of running wires indoors. The list is accompanied by some plain and sensible directions for placing and securing the safety tubes.

The Pittsburgh Reduction Company, manufacturers of pure aluminum at Pittsburgh, have ordered an increase of their present plant. The additions will comprise two 125,000-watt dynamos from the United States Electric Lighting Company; two 250 h. p. Westinghouse engines, and two 250 h. p. boilers. These will be put in a new building, and the plant will be in shape by April 1, when, President A. E. Hunt reports, the output will be increased six-fold.

The Canada Electric Company, of Amherst, N. S., is a pushing and prosperous concern. Its officers are T. H. Griffin, president; J. H. Wagstaff, business manager, secretary and treasurer; D. M. Bliss, electrician; W. W. Casey, mechanical superintendent; W. I. Sibley, engineer of the lighting department. The company does a local lighting and power business, and one motor supplied by it runs the newspaper and job offices of the Amherst *Record*. It also is actively engaged in electrical manufacturing, and has already turned out dynamos, motors, telephones, etc. It has expended $20,000 on its plant and is rapidly enlarging.

The Gilliland Electric Company gave to their employés and friends a ball and "house-warming" upon the occasion of the opening of their new shop building at Adrian, Mich., on the evening of Dec. 28. The new finishing room was set apart for a supper room, while the dancing was done in the large main room. Three hundred guests were present, of whom a number were from other cities. Several phonographs in the supper room furnished entertainment while the refreshments were being served. The shops were lighted from top to bottom with hundreds of electric lamps, and every possible effort was made for the pleasure of those present. Altogether, as we gather from the accounts in the local papers, the occasion was most enjoyable.

A Fetching Invention.—A special dispatch from Erie, Pa., of Jan. 9, says: "Electricians in this section of the State were invited by Superintendent Jacob Pfetch, of the Erie Motor Car Company, to witness a test of personal insulation yesterday. Pfetch, alarmed at the fatalities at New York and elsewhere, studied day and night to arrest the danger lying in the overcharged wires. He fortified himself, and, taking hold of the buzz (*sic*) rod of the dynamos in his bare hands, which he had dipped in water, he then stepped upon a pile of wet dirt and received the full charge, over 500 volts, the force used to operate about ten miles of road. To the surprise of every one the electricity did not ground, and the superintendent felt no effects whatever. The invention is a secret to himself, and upon which he will apply for a patent at once. The insulation enables linemen and others to handle any wire with safety, and is an absolute protection."

Cab Fare Regulation in Paris.—Paris is about trying an experiment. An attempt is to be made to regulate cab-fares automatically, so as to leave the coacher out of the question as to the amount to be paid. Seven cabs have recently been furnished with seven different and rival methods of ascertaining the amounts of 10 different fares. They vary little in design, the experiment being to ascertain which will work with the greatest accuracy and least cost. As the passenger enters the cab he sets free an electric current, which at once registers on a dial his present liability, half a franc, for taking the vehicle. As the cab proceeds the dial registers 25 centimes for each kilometre of the journey, so that the passenger can tell at any moment the number of miles he has gone, and the exact fare he owes. The seven systems are to be on trial for a month, at the end of which time one will be adopted by the government, and every cab in Paris provided with it.

The D. M. Steward Manufacturing Company, of Chattanooga, Tenn., report that their trade in patent lava insulation during the last four months of 1889 was a long way in advance of that of any other similar period. They received a number of single orders for 100,000 pieces, and hundreds for from 1,000 to 25,000 pieces. Among their regular and largest customers are such concerns as the Thomson-Houston Company, Bergmann & Co., the Western Electric Company, the Sperry Electric Company, the Detroit Electric Company, etc. "We never lose a customer," the company say. "Our insulation stands a greater heat than anything used for insulating purposes, and we make pieces to fit to one-thousandth of an inch. No other insulator that stands heat can be worked so close to size. We have recently bought a newly-discovered mine of the very best grade of crude material we have ever seen for insulators, and have tested it by working up about ten car-loads. We are more than pleased with it. As a test we have heated an insulator to a white heat, and plunged it into cold water without cracking or injuring it in the least."

BUSINESS NOTICES.

The Electrical Supply Company, of Chicago, are experiencing an enormous demand for their fuse wire, which everybody says is *the thing*.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidently grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

The John T. Noye Manufacturing Company, of Buffalo, N. Y., have recently completed an arrangement with Fairbanks, Morse & Co., whereby that firm become their Western representatives for the sale of the Rice automatic engine, through their houses in Chicago, St. Louis, Kansas City, Omaha, Denver and St. Paul. The territory assigned to these representatives includes Michigan, but not Ohio or anything east of that State. This well-advised step has been taken in order to keep pace in the section named with the rapidly growing sale of and demand for the Rice engine.

Houston's Electrical Dictionary.—*Power-Steam* says: "The rapid growth of electrical science and the almost daily addition to it of new words, terms and phrases have led to the production of an electrical vocabulary that is already bewildering in its extent. This multiplicity of words is extremely discouraging to the student, and acts as an obstacle to the general dissemination of electrical knowledge. To furnish definite and comprehensive definition of the terms now in use is the function of the work under review, and in this it is more than its name implies, the descriptions in many cases exceeding the brief dismissal of the subject, which is implied by the word dictionary, and extending into quite elaborate, though concise, descriptions of the apparatus and principles connected with electrical science and practice. The work is nicely printed upon a fine grade of paper and profusely illustrated."

Intelligent people, who are familiar with the respective advantages which are offered by the several competing railroad lines between Chicago, St. Louis and Kansas City, and who desire to travel with the utmost speed, safety and comfort, always take the popular and reliable Chicago & Alton Railroad between these points, and passengers going to, or coming from, the South, via St. Louis, or when going to, or coming from, the West, via Kansas City, should insist upon having tickets that read over the Chicago & Alton. It is the only road with three complete and elegantly equipped through trains daily between Chicago and each of the points named, and no railroad managers in America have a more intelligent appreciation of the wants of the traveling public than do those of the famous Chicago & Alton, and who will do all in their power to render the trip a peculiarly pleasant one to all of the electrical fraternity who pass over their lines en route to Kansas City to attend the convention.

The Page Belting Company have just closed a very prosperous year in their business, the increase having been unparalleled in their history hitherto. This growth of business has not been confined to our own country, but has been extended into foreign lands, especially in Japan, that Empire whose progress in civilization is the wonder and admiration of the whole world During the past year they have put upon the market some specialties in their line which are being received with great favor. This is especially true of their "Acme" link belts and "Eureka" dynamo belts. The "Acme" link belt is being extensively advertised, and has already become familiar to a large number of manufacturers and merchants. Its great superiority over link belts as hitherto made secures for it a large and rapidly growing demand. Manufacturers appreciate a link belt that has solid contact with the pulley, not only in the direction of its circumference, but also across the face. The "Eureka" dynamo belt meets a long felt want on the part of electricians and engineers, a belt with the utmost possible traction, the least possible stretch and perfect straightness of running. It is not strange that the Page Belting Company are receiving large orders for these superior belts for electrical purposes

Owing to the pressure on our columns, the Patent Record has been omitted this week.